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**PROPOSED
TOTAL MAXIMUM DAILY LOAD (TMDL)
For
Nutrient
In
Tomoka River (Fresh Water)
(WBID 2634)**

November 2012



Acknowledgments

EPA would like to acknowledge that the contents of this report and the total maximum daily load (TMDL) contained herein were developed by the Florida Department of Environmental Protection (FDEP). Many of the text and figures may not read as though EPA is the primary author for this reason, but EPA is officially proposing the TMDL for nutrients for Tomoka River and is soliciting comment. EPA is proposing this TMDL in order to meet consent decree requirements pursuant to the Consent Decree entered in the case of Florida Wildlife Federation, et al. v. Carol Browner, et al., Case No. 98-356-CIV-Stafford. EPA will accept comments on this proposed TMDL for 60 days in accordance with the public notice issued on November 30, 2012. Should EPA be unable to approve a TMDL established by FDEP for the 303(d) listed impairment addressed by this report, EPA will establish this TMDL in lieu of FDEP, after full review of public comments.

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Websites

Florida Department of Environmental Protection, Bureau of Watershed Management

TMDL Program

<http://www.dep.state.fl.us/water/tmdl/index.htm>

Identification of Impaired Surface Waters Rule

<http://www.dep.state.fl.us/water/tmdl/docs/AmendedIWR.pdf>

STORET Program

<http://www.dep.state.fl.us/water/storet/index.htm>

2012 305(b) Report

http://www.dep.state.fl.us/water/docs/2012_integrated_report.pdf

Basin Assessment Report for the Upper East Coast Basin

<http://www.dep.state.fl.us/water/basin411/uppereast/assessment.htm>

U.S. Environmental Protection Agency, National STORET Program

<http://www.epa.gov/storet/>

Chapter 1: INTRODUCTION

1.1 Purpose of Report

This report presents the Total Maximum Daily Load (TMDL) for nutrients for the Tomoka River in the Halifax River Planning Unit of the Upper East Coast Basin. The segment was verified as impaired for nutrients based on chlorophyll *a* during the second cycle, and was included on the Verified List of impaired waters for the Upper East Coast Basin that was adopted by Secretarial Order on February 7, 2012. Based on the median TN/TP ratio of 18.1, total nitrogen and total phosphorus were identified as co-limiting nutrients. This TMDL establishes the allowable loadings to this portion of the Tomoka River that would restore the waterbody so that it meets its applicable water quality criterion for nutrients.

1.2 Identification of Waterbody

The Tomoka River, located in Volusia County, originates in wetlands southwest of Daytona Beach and flows north until it turns northeast and enters the Halifax River north of Ormond Beach. For assessment purposes, the Tomoka River has been divided into a fresh water and a marine segment. This TMDL addresses the fresh water portion of the Tomoka River. The fresh water segment of the Tomoka River is approximately 13.6 miles long, with a watershed area of approximately 30 square miles. Interstate 95 crosses the Tomoka River and through the watershed, while Interstate 4 intersects the southern portion of the watershed. **(Figure 1.1)**.

For assessment purposes, the Florida Department of Environmental Protection (Department) has divided the Upper East Coast Basin into water assessment polygons with a unique **waterbody identification (WBID)** number for each watershed or stream reach. This TMDL addresses WBID 2634, the fresh water segment of the Tomoka River for nutrients **(Figure 1.2)**.

The Tomoka River watershed is part of the Halifax River Planning Unit. Planning units are groups of smaller watersheds (WBIDs) that are part of a larger basin unit, in this case the Upper East Basin. The Halifax River Planning Unit consists of 56 WBIDs. **Figure 1.3** shows the locations of these WBIDs and the Halifax River's location in the planning unit.

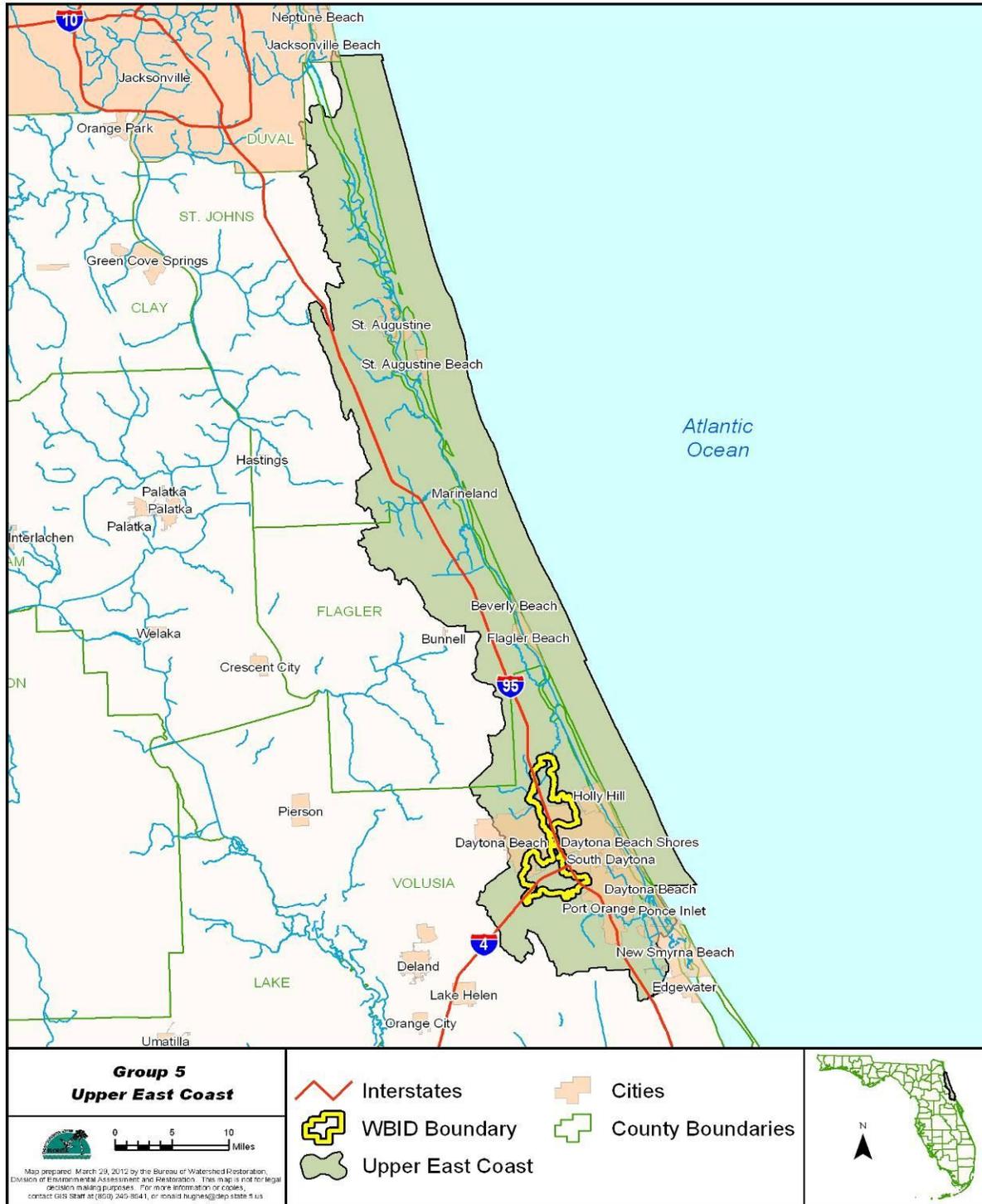
1.3 Background

This report was developed as part of the Department's watershed management approach for restoring and protecting state waters and addressing TMDL Program requirements. The watershed approach, which is implemented using a cyclical management process that rotates through the state's 52 river basins over a 5-year cycle, provides a framework for implementing the TMDL Program-related requirements of the 1972 federal Clean Water Act and the 1999 Florida Watershed Restoration Act (FWRA) (Chapter 99-223, Laws of Florida).

A TMDL represents the maximum amount of a given pollutant that a waterbody can assimilate and still meet water quality standards, including its applicable water quality criteria and its designated uses. TMDLs are developed for waterbodies that are verified as not meeting their

water quality standards. They provide important water quality restoration goals that will guide restoration activities.

Figure 1.1. Location of the Tomoka River (WBID 2634) in Volusia County



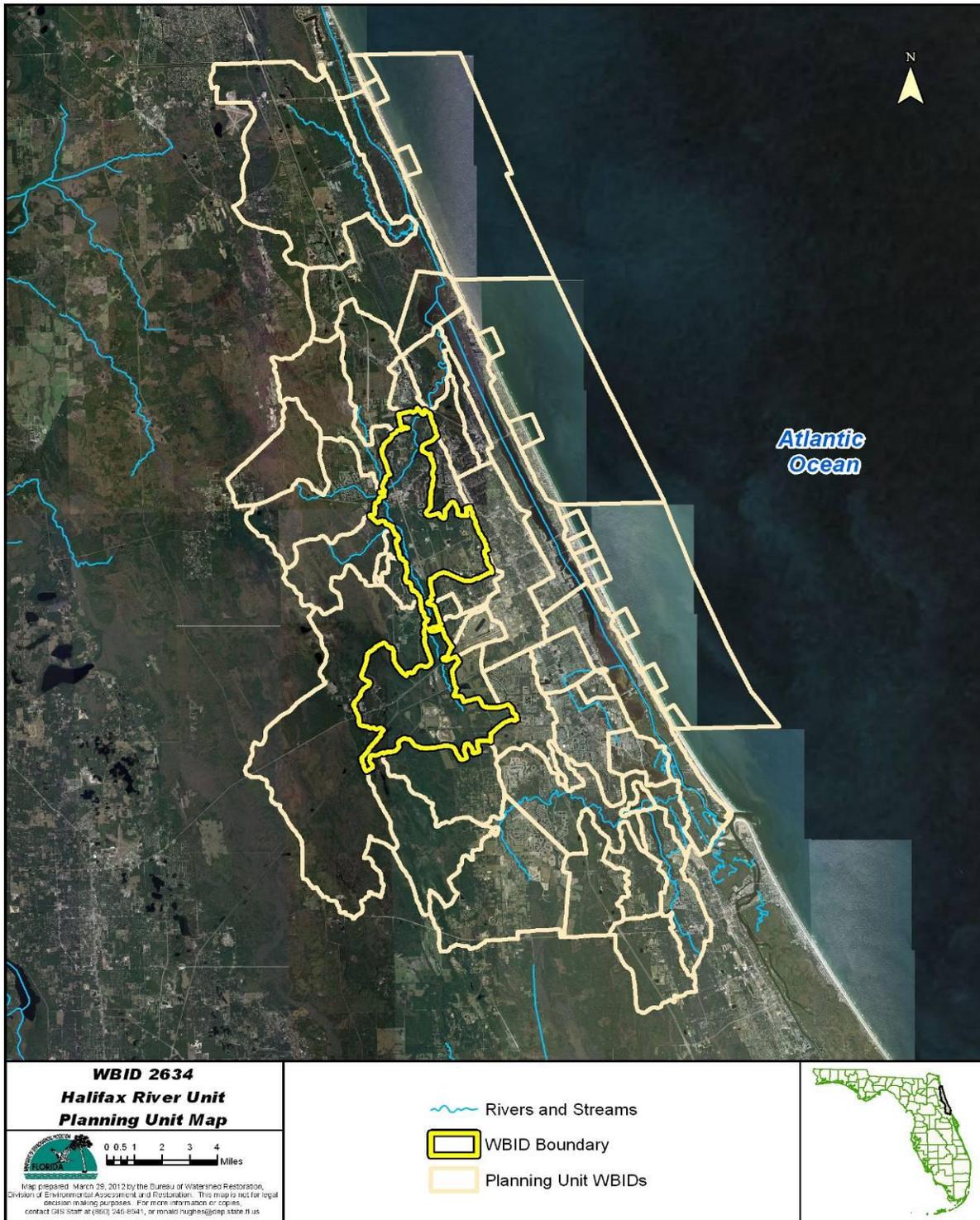
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Figure 1.2. Location of the Tomoka River (WBID 2634) in Volusia County and Major Hydrological Features in the Area



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Figure 1.3. WBIDs in the Halifax River Planning Unit



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Chapter 2: DESCRIPTION OF WATER QUALITY PROBLEM

2.1 Statutory Requirements and Rulemaking History

Section 303(d) of the federal Clean Water Act requires states to submit to the U.S. Environmental Protection Agency (EPA) lists of surface waters that do not meet applicable water quality standards (impaired waters) and establish a TMDL for each pollutant causing the impairment of listed waters on a schedule. The Department has developed such lists, commonly referred to as 303(d) lists, since 1992. The list of impaired waters in each basin, referred to as the Verified List, is also required by the FWRA (Subsection 403.067[4], Florida Statutes [F.S.]); the state's 303(d) list is amended annually to include basin updates.

Florida's 1998 303(d) list included 15 waterbodies and 50 parameters in the Upper East Coast Basin. However, the FWRA (Section 403.067, F.S.) stated that all previous Florida 303(d) lists were for planning purposes only and directed the Department to develop, and adopt by rule, a new science-based methodology to identify impaired waters. After a long rulemaking process, the Environmental Regulation Commission adopted the new methodology as Rule 62-303, Florida Administrative Code (F.A.C.) (Identification of Impaired Surface Waters Rule, or IWR), in April 2001; the rule was modified in 2006 and 2007.

2.2 Information on Verified Impairment

The Department used the IWR to assess water quality impairments in the Tomoka River watershed and has verified that this fresh water waterbody segment is impaired for nutrients, based on data in the Department's IWR database. **Tables 2.1** and **2.2** summarize the corrected chlorophyll *a* (CHLAC) data for the verification period, which for Cycle 2 of the Group 5 waters was January 1, 2004, through June 30, 2011.

The IWR listing threshold for nutrients in estuaries was based on exceeding the historic minimum of 3 ug/L by more than 50 percent in at least two consecutive years (2008 – 2010).

Possible relationships between chl_a and other water quality parameters are further assessed in Chapter 5, using the complete historical dataset.

Table 2.1. Summary of Corrected Chlorophyll *a* (CHLAC) Monitoring Data for Tomoka River (WBID 2634) During the Verified Period (January 1, 2004 – June 30, 2011)

Parameter	CHLAC (µg/L)
Total number of samples	237
IWR-annual average threshold for the Verified List	5
Number of observed exceedances	2
Number of observed nonexceedances	4
Number of seasons during which samples were collected	4
Annual average resulting in listing (µg/L)	5
Lowest individual observation (µg/L)	1
Highest individual observation (µg/L)	28
Median TN/TP ratio for 186 observations	18.1
Possible causative pollutant by IWR	TN and TP
FINAL ASSESSMENT:	Impaired

Table 2.2. Summary of Annual Average CHLAC for the Cycle 2 Verified Period (January 1, 2004 – June 30, 2011)

CHLAC is in µg/L.

Year	Number of Samples	Minimum	Maximum	Annual Mean	Mean Precipitation (inches)
2004	15	2.4	15.5	2	62.97
2005	36	1.0	12.2	2	65.77
2006	17	2.0	7.3	1	31.36
2007	16	2.2	12.6	1	45.02
2008	64	1.2	10.0	10	42.67
2009	50	1.6	21.0	11	50.3
2010	33	2.4	28.0	6	39.39
2011	6	3.4	7.8		48.71

Precipitation based on Daytona International Airport (Appendix F)

Chapter 3. DESCRIPTION OF APPLICABLE WATER QUALITY STANDARDS AND TARGETS

3.1 Classification of the Waterbody and Criteria Applicable to the TMDL

Florida's surface waters are protected for five designated use classifications, as follows:

Class I	Potable water supplies
Class II	Shellfish propagation or harvesting
Class III	Recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife
Class IV	Agricultural water supplies
Class V	Navigation, utility, and industrial use (there are no state waters currently in this class)

The Tomoka River (WBID 2634) is a Class III fresh water waterbody, with a designated use of recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife. The Class III water quality criterion applicable to the impairment addressed by this TMDL is for nutrients.

3.2 Applicable Water Quality Standards and Numeric Water Quality Target

The nutrient criterion in Rule 62-302, F.A.C., is expressed as a narrative:

Nutrients:

In no case shall nutrient concentrations of a body of water be altered so as to cause an imbalance in natural populations of aquatic flora or fauna [Note: For Class III waters in the Everglades Protection Area, this criterion has been numerically interpreted for phosphorus in Section 62-302.540, F.A.C.].

To assess whether this narrative criterion was being exceeded, the IWR provides thresholds for nutrient impairment in estuaries based on annual average chl_a levels. The following language is found in Rule 62-303, F.A.C.:

62-303.351 Nutrients in Streams.

A stream or stream segment shall be included on the planning list for nutrients if the following biological imbalances are observed:

- (1) Algal mats are present in sufficient quantities to pose a nuisance or hinder reproduction of a threatened or endangered species, or*
- (2) Annual mean chlorophyll a concentrations are greater than 20 ug/l or if data indicate annual mean chlorophyll a values have increased by more than 50% over historical values for at least two consecutive years.*

62-303.450 Interpretation of Narrative Nutrient Criteria.

- (1) A water shall be placed on the verified list for impairment due to nutrients if there are sufficient data from the last five years preceding the planning list*

assessment, combined with historical data (if needed to establish historical chlorophyll a levels or historical TSIs), to meet the data sufficiency requirements of subsection 62-303.350(2), F.A.C. If there are insufficient data, additional data shall be collected as needed to meet the requirements. Once these additional data are collected, the Department shall determine if there is sufficient information to develop a site-specific threshold that better reflects conditions beyond which an imbalance in flora or fauna occurs in the water segment. If there is sufficient information, the Department shall re-evaluate the data using the site-specific thresholds. If there is insufficient information, the Department shall re-evaluate the data using the thresholds provided in Rules 62-303.351-.353, F.A.C., for streams, lakes, and estuaries, respectively. In any case, the Department shall limit its analysis to the use of data collected during the five years preceding the planning list assessment and the additional data collected in the second phase. If alternative thresholds are used for the analysis, the Department shall provide the thresholds for the record and document how the alternative threshold better represents conditions beyond which an imbalance in flora or fauna is expected to occur.

The annual average chl_a concentrations in 2008, 2009, and 2010 exceeded the historic minimum of 3.0 ug/L by 50% or greater, and, based on the TN/TP ratio, nitrogen and phosphorus were identified as co-limiting nutrients.

Chapter 4: ASSESSMENT OF SOURCES

4.1 Types of Sources

An important part of the TMDL analysis is the identification of pollutant source categories, source subcategories, or individual sources of pollutants in the watershed and the amount of pollutant loading contributed by each of these sources. Sources are broadly classified as either “point sources” or “nonpoint sources.” Historically, the term “point sources” has meant discharges to surface waters that typically have a continuous flow via a discernable, confined, and discrete conveyance, such as a pipe. Domestic and industrial wastewater treatment facilities (WWTFs) are examples of traditional point sources. In contrast, the term “nonpoint sources” was used to describe intermittent, rainfall-driven, diffuse sources of pollution associated with everyday human activities, including runoff from urban land uses, agriculture, silviculture, and mining; discharges from failing septic systems; and atmospheric deposition.

However, the 1987 amendments to the Clean Water Act redefined certain nonpoint sources of pollution as point sources subject to regulation under the EPA’s National Pollutant Discharge Elimination System (NPDES) Program. These nonpoint sources included certain urban stormwater discharges, including those from local government master drainage systems, construction sites over five acres, and a wide variety of industries (see **Appendix A** for background information on the federal and state stormwater programs).

To be consistent with Clean Water Act definitions, the term “point source” will be used to describe traditional point sources (such as domestic and industrial wastewater discharges) **AND** stormwater systems requiring an NPDES stormwater permit when allocating pollutant load reductions required by a TMDL (see **Section 6.1**). However, the methodologies used to estimate nonpoint source loads do not distinguish between NPDES stormwater discharges and non-NPDES stormwater discharges, and as such, this source assessment section does not make any distinction between the two types of stormwater.

4.2 Potential Sources of Nutrients in the Tomoka River Watershed

4.2.1 Point Sources

There is one NPDES wastewater facility that discharges directly into this portion of the Tomoka River. The Tomoka Farms Road Landfill (FL0037877) has a design discharge of 0.11 MGD. Over the January 2000 through March 2012 period (202 months) there were 16 months when discharge occurred. The average of the reported monthly maximum discharge events was 0.89 MGD. Daily maximum concentrations of TN and TP were reported for October 2011 and were 0.93 mg/L and < 0.05 mg/L, respectively.

Municipal Separate Storm Sewer System Permittees

Portions of the Tomoka River fall within the boundaries of several Phase II municipal separate storm sewer system (MS4) permits. These include the Phase II permits for the City of Daytona

Beach (FLR04E0115) and Volusia County (FLR04E033). The Florida Department of Transportation District 5 is a co-permittee with Volusia County (FLR04E024).

4.2.2 Land Uses and Nonpoint Sources

Nutrient loadings to the Tomoka River are generated from nonpoint sources in the watershed. These potential sources include loadings from surface runoff, ground water inflow, and septic tanks.

Land Uses

The spatial distribution and acreage of different land use categories were identified using the SJRWMD’s year 2004 land use coverage contained in the Department’s geographic information system (GIS) library. Land use categories in the watershed were aggregated using the Level 3 land use codes and tabulated in **Table 4.1**. **Figure 4.1** shows the principal land uses in the watershed at the Level 1 land use code. The SJRWMD’s year 2009 land use coverage was also compared to the 2004 coverage and there were insignificant differences between the two periods.

As shown in **Table 4.1**, the total area of the Tomoka River watershed (WBID 2634) is about 19,053 acres. Water and wetlands represents approximately 32 percent of the watershed with forested land uses accounting for approximately 30 of the watershed. Residential land use accounts for approximately 11 percent of the watershed with nearly 8 percent of the watershed classified as medium density residential. Agricultural and rangeland land uses represented 10 percent of the watershed area.

Table 4.1. Classification of Land Use Categories in the Tomoka River Watershed

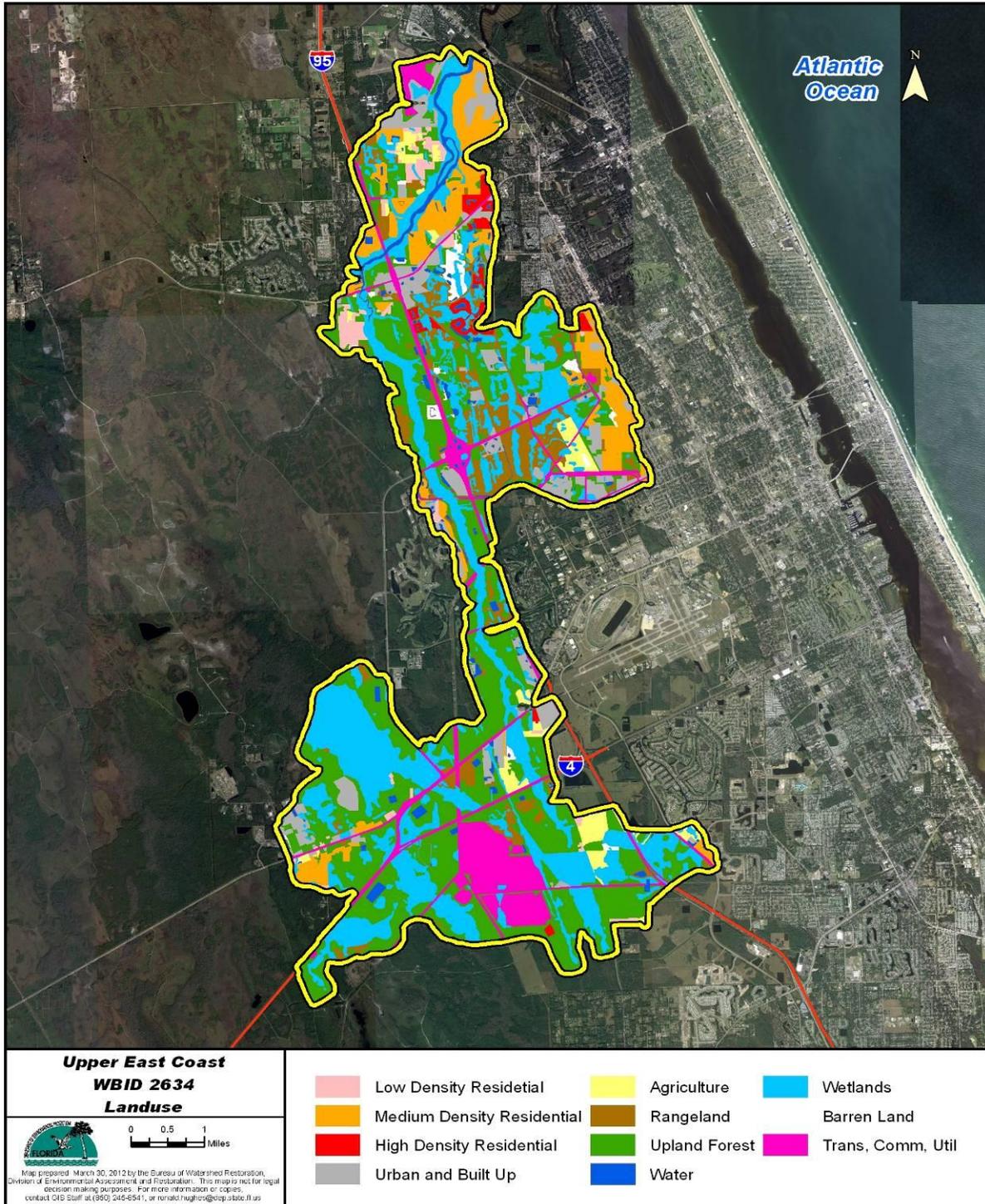
Level 3 Land Use Code	Attribute	Acres	% of Total
1100	Residential, low density - less than 2 dwelling units/acre	251.03	1.32
1180	Rural residential	64.62	0.34
1190	Low density under construction	9.13	0.05
1200	Residential, medium density - 2-5 dwelling units/acre	1421.69	7.46
1290	Medium Density Under Construction	47.6	0.25
1300	Residential, high density - 6 or more dwelling units/acre	252.61	1.33
1400	Commercial and services	670.77	3.52
1490	Commercial & services under construction	39.84	0.21
1550	Other light industrial	66.85	0.35
1600	Extractive	24.35	0.13
1620	Sand and Gravel Pits	11.48	0.06
1660	Holding ponds	49.3	0.26

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Level 3 Land Use Code	Attribute	Acres	% of Total
1700	Institutional	190.8	1.00
1820	Holding ponds	242.63	1.27
1860	Institutional	29.82	0.16
1900	Open land	14.89	0.08
2110	Improved pastures (monocult, planted forage crops)	331.8	1.74
2130	Woodland pastures	46.5	0.24
2150	Field crops	123.54	0.65
2210	Citrus Groves <Orange, grapefruit, tangerines, etc.>	0.92	0.00
3100	Herbaceous upland nonforested	659.46	3.46
3200	Shrub and brushland (wax myrtle or saw palmetto, occasionally scrub)	273.6	1.44
3300	Mixed upland nonforested/Mixed Rangeland	455.78	2.39
4110	Pine flatwoods	2654.8	13.93
4120	Longleaf pine - xeric oak	21.3	0.11
4130	Sand pine	113.88	0.60
4200	Upland hardwood forests	49.97	0.26
4340	Upland mixed coniferous/hardwood	741.84	3.89
4410	Coniferous pine	916.86	4.81
4430	Forest regeneration areas	1294.39	6.79
5100	Streams and waterways	156.92	0.82
5300	Reservoirs - pits, retention ponds, dams	357.58	1.88
6110	Bay swamp (if distinct)	284.82	1.49
6170	Mixed wetland hardwoods	1602.09	8.41
6181	Willow and Elderberry	38.4	0.20
6210	Cypress	193.06	1.01
6220	Pond Pine	1.35	0.01
6250	Hydric pine flatwoods	848.9	4.46
6300	Wetland forested mixed	1492.25	7.83
6410	Fresh water marshes	82.66	0.43
6420	Saltwater marshes	72.19	0.38
6430	Wet prairies	296.98	1.56
6440	Emergent aquatic vegetation	14.27	0.07
6460	Treeless Hydric Savanna/Mixed scrub-shrub wetland	573.72	3.01
7400	Disturbed land	21.45	0.11
7410	Rural land in transition without positive indicators of intended activity	137.77	0.72
7420	Borrow Areas	20.84	0.11
7430	Spoil areas	12.42	0.07
8110	Airports	95.99	0.50
8140	Roads and highways (divided 4-lanes with medians)	670.26	3.52
8200	Communications	8.65	0.05
8320	Electrical power transmission lines	244.13	1.28

Level 3 Land Use Code	Attribute	Acres	% of Total
8350	Solid Waste Disposal	749.56	3.93
8370	Surface water collection basins	4.6	0.02
	SUM	19052.9	100.00

Figure 4.1. Principal Land Uses in the Tomoka River Watershed



Soil Characteristics

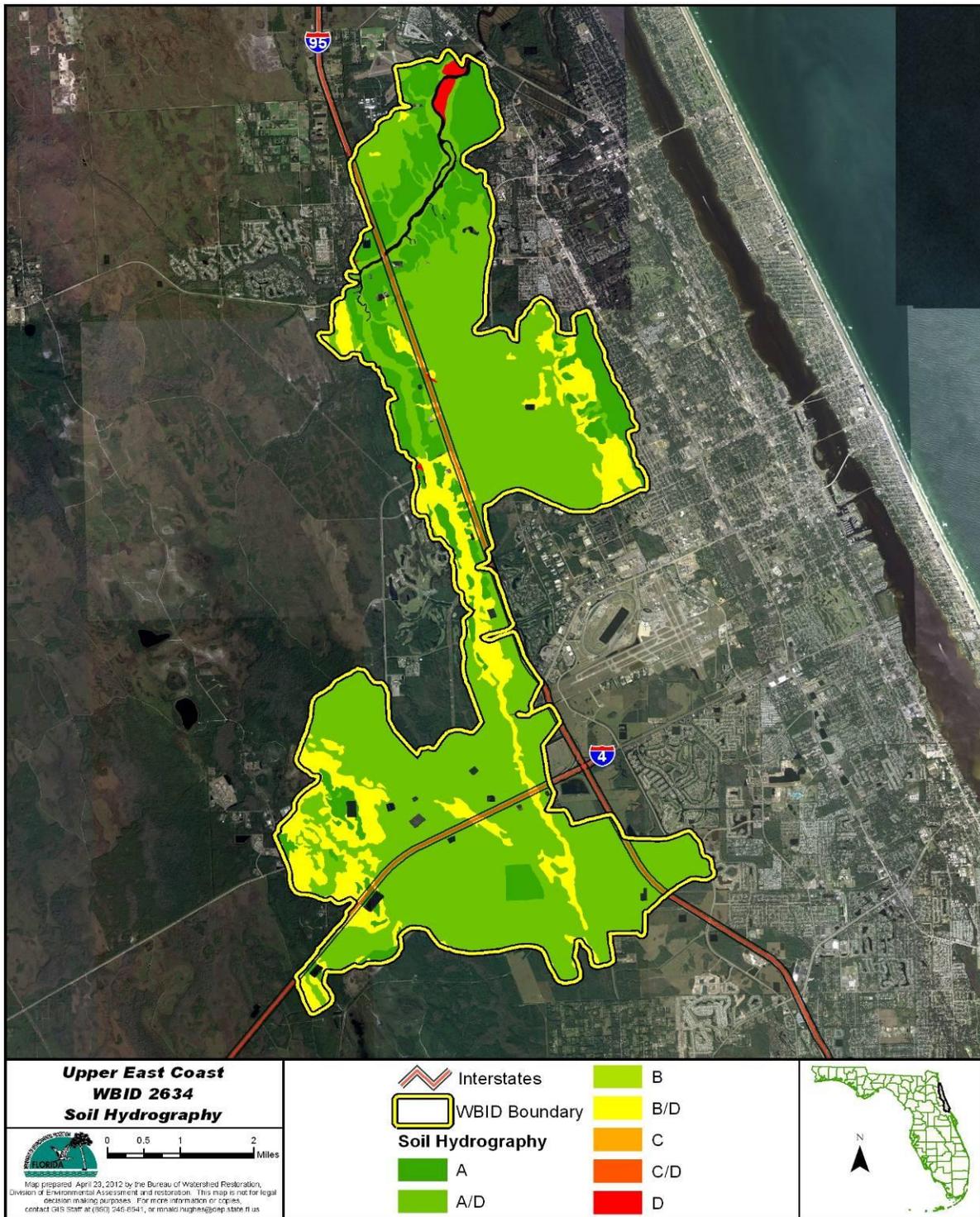
The Soil Survey Geographic Database (SSURGO) in the Department’s GIS database from the SJRWMD was accessed to provide coverage of hydrologic soil groups in the Tomoka River watershed (**Figure 4.2**). **Table 4.2** briefly describes the major hydrology soil classes. As seen in **Figure 4.2**, soil group A/D was the most common in the watershed

Table 4.2. Description of Hydrologic Soil Classes from the SSURGO Database

Hydrology Class	Description
A	Soils in this group have low runoff potential when thoroughly wet. Water is transmitted freely through the soil. Group A soils typically have less than 10 percent clay and more than 90 percent sand or gravel and have gravel or sand textures.
B	Soils in this group have moderately low runoff potential when thoroughly wet. Water transmission through the soil is unimpeded. Group B soils typically have between 10 percent and 20 percent clay and 50 percent to 90 percent sand and have loamy sand or sandy loam textures.
C	Soils in this group have moderately high runoff potential when thoroughly wet. Water transmission through the soil is somewhat restricted. Group C soils typically have between 20 percent and 40 percent clay and less than 50 percent sand and have loam, silt loam, sandy clay loam, clay loam, and silty clay loam textures
D	Soils in this group have high runoff potential when thoroughly wet. Water movement through the soil is restricted or very restricted. Group D soils typically have greater than 40 percent clay, less than 50 percent sand, and have clayey textures.
<i>Dual hydrologic soil groups</i>	Certain wet soils are placed in group D based solely on the presence of a water table within 60 centimeters [24 inches] of the surface even though the saturated hydraulic conductivity may be favorable for water transmission. If these soils can be adequately drained, then they are assigned to dual hydrologic soil groups (A/D, B/D, and C/D) based on their saturated hydraulic conductivity and the water table depth when drained. The first letter applies to the drained condition and the second to the undrained condition. For the purpose of hydrologic soil group, adequately drained means that the seasonal high water table is kept at least 60 centimeters [24 inches] below the surface in a soil where it would be higher in a natural state.
Source: : USDA NRCS, Part 630 Hydrology National Engineering Handbook , Chapter 7 Hydrologic Soil Groups, January 2009	

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Figure 4.2 Hydrologic Soil Groups Distribution in the Tomoka River Watershed



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Population

The 2010 U.S. Census block data was used to estimate the human population in the Tomoka River watershed. Total population data for census blocks covering the Tomoka River watershed was clipped using GIS to estimate the population within the watershed based on the fraction of the block contained within the watershed. This yielded an estimated population of 13,452 in the Tomoka River watershed. Based on an average of 2.51 persons per household in Volusia County (U.S Census) there was an estimated 5,359 occupied residential units within the WBID boundary.

Septic Tanks

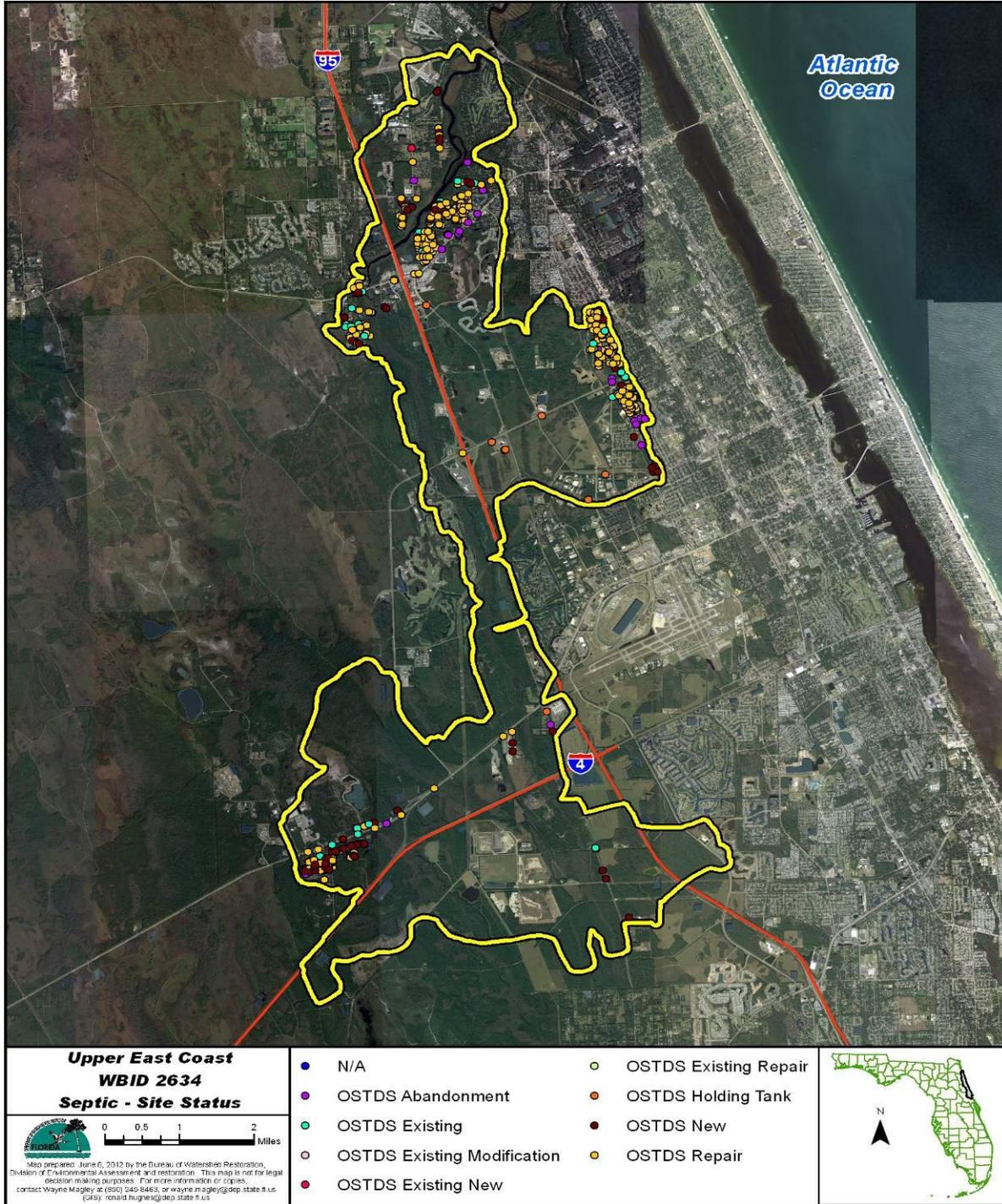
Based on the Florida Department of Health January 2012 GIS coverage of onsite sewage treatment disposal systems (OSTDS), there were approximately 643 septic tanks located in the watershed (**Figure 4.3**). Using 70 gallons/day/person (EPA, 1999), and drainfield total nitrogen (TN) and total phosphorus (TP) concentrations of 36 mg/L and 15 mg/L, respectively, potential annual ground water loads of TN and TP were calculated. This is a screening level calculation, and soil types, the age of the system, vegetation, proximity to a receiving water, and other factors will influence the degree of attenuation of this load (**Table 4.3**).

Table 4.3. Estimated Nitrogen and Phosphorus Annual Loading from Septic Tanks in the Tomoka River Watershed

Estimated No. Households on Septic	Estimated No. Persons Per Household ¹	Gallons/ Person/ Day ²	TN in Drainfield (mg/L)	TP in Drainfield (mg/L)	Estimated Annual TN Load (lbs/yr)	Estimated Annual TP Load (lbs/yr)
643	2.51	70	36	15	12,388	5,161

¹ U.S Census Bureau;
² EPA, 1999.

Figure 4.3. Onsite Sewage Treatment Disposal Systems in the Tomoka River Watershed



US EPA ARCHIVE DOCUMENT

4.3 Source Summary

4.3.1 Summary of Nutrient Loadings to Tomoka River from Point Sources

Section 4.2.1 provided information on the one point source discharge in the watershed. (Tomoka Farms Road Landfill). A conservative approach was used to estimate annual TN and TP loads based on discharge monitoring reports. For each month in which a discharge was reported, a load was calculated assuming that the daily maximum reported discharge occurred for the whole month and that TN and TP concentrations in the discharge were equal to 0.93 mg/L and 0.05 mg/L, respectively (**Table 4.4**).

Table 4.4. Estimated Annual Average Discharge, TN and TP Loads from the Tomoka Farms Road Landfill

YEAR	DISCHARGE (MG/ACRE-FT)	TN LOAD (LBS/YR)	TP LOAD (LBS/YR)
1999	0	0	0
2000	0	0	0
2001	60/186	469	25
2002	0	0	0
2003	0	0	0
2004	0	0	0
2005	0	0	0
2006	0	0	0
2007	0	0	0
2008	75/231	584	31
2009	135/414	1048	56
2010	95/293	741	40
2011	23/72	182	10

4.3.2 Summary of Nutrient Loadings to Tomoka River from Nonpoint Sources

As part of EPA's efforts to establish numeric nutrient criteria for Florida's estuaries, Tetra Tech setup a watershed model (LSPC) to estimate nutrient loadings to the Mantanzas and Halifax River estuaries. The model simulation covered the 1997 – 2009 period. Ms. Erin Lincoln (Tetra Tech, personal communication, 5/2/2012) provided model outputs of daily flow, TN concentration, TP concentrations, TN loads, and TP loads based on HUC 12 delineations. Daily flows and nutrient loads were summed by year to obtain estimates of annual nitrogen and phosphorus loadings from the Tomoka watershed (**Table 4.5**). These estimates did not include potential contribution of the marine segment of the Tomoka River.

Table 4.5. Estimated Annual Average LSPC Derived Discharge, TN, TP Loads and Concentrations from the Tomoka River Watershed

YEAR	DISCHARGE (ACRE-FT)	TN LOAD (LBS/YR)	TP LOAD (LBS/YR)	MEAN TN (MG/L)	MEAN TP (MG/L)	RAINFALL (INCHES/YR)
1997	77293	255465	19606	1.18	0.095	54.69
1998	76406	265739	17446	1.27	0.102	40.51
1999	37663	133992	14093	1.32	0.120	46.37
2000	37612	128705	11952	1.25	0.111	40.16
2001	167150	529670	32105	1.18	0.083	58.27
2002	94904	300034	19138	1.10	0.077	59.94
2003	135629	438091	24496	1.14	0.075	57.3
2004	173117	562603	34182	1.12	0.079	62.97
2005	260400	848249	49287	1.17	0.065	65.77
2006	49006	153621	11584	1.12	0.086	31.36
2007	40967	127797	11092	1.26	0.099	45.02
2008	108896	350285	21926	1.19	0.089	42.67
2009	94333	309810	20410	1.11	0.091	50.3
AVERAGE	104106	338774	22101	1.19	0.090	50.41

Precipitation based on Daytona International Airport (Appendix F)

Chapter 5: DETERMINATION OF ASSIMILATIVE CAPACITY

5.1 Determination of Loading Capacity

5.1.1 Data Used in the Determination of the TMDL

There are sixty-three sampling stations in the watershed, of which fifty-eight have historical CHLAC observations (**Figure 5.1**). Thirty-three of those sites had only one CHLAC observation. **Table 5.1** contains summary information on each of the stations (N represents the number of CHLAC observations). **Table 5.2** provides a statistical summary of CHLAC observations at each station, and **Appendix B** contains historical CHLAC, temperature (TEMPC), TN, TP, and TSS available observations from sampling sites in WBID 2634 from 1968 through 2011. **Figure 5.2** displays the historical CHLAC observations over time. Although the R^2 was very low, the simple linear regression of CHLAC versus sampling date in **Figure 5.2** was significant at an alpha (α) level of 0.05 ($R^2 = 0.008$) and indicated an increasing trend in CHLAC. **Appendix E** contains plots of CHLAC by year, season, and station,.

Elevated levels of CHLAC during June 2008 are shown in **Figure 5.1**. Seven of the highest eleven historical CHLAC measurements were reported at the seven randomized ambient monitoring stations (21FLGW 34952 – 34958) collected between June 17 – 19, 2008 in the northern most 4.64 miles of the Tomoka River WBID 2634 segment. CHLAC concentrations ranged from 48 to 450 ug/L at these stations. Salinities reported at these station during this period ranged between 21.4 and 24.1 ppt. With respect to historical CHLAC measurements, the 75th, 80th, and 90th percentiles are 2.8 ug/L, 4.2 ug/L, and 12.88 ug/L, respectively. Similarly, based on historical salinity measurements the 75th, 80th and 90th percentiles are 0.23 ppt, 0.58 ppt, and 11.5 ppt, respectively.

Figures 5.3 through **5.6** present historical TN, TP, Color, and Total Suspended Solids (TSS) observations, respectively. Linear regressions of each parameter versus sampling date indicated that none of the regressions were significant at an α level of 0.05. **Appendix E** contains additional plots by season, station, and year. A statistical summary of major water quality parameters from the available data is presented in **Table 5.3**.

Table 5.1. Sampling Station Summary for the Tomoka River Watershed

Station	STORET ID	Station Owner	Years With Data	N
CANAL TO TOMOKA @ 265 CHEROKEE RD	21FLA 27010429FLA	FDEP	2009	5
TOMOKA RIVER BETWEEN AIRPORT DITCH AND ISLAND	21FLA 27010572	FDEP	1985 - 1986	7
TOMOKA RIVER EAST FORK AROUND ISLAND	21FLA 27010573	FDEP	1985 - 1986	7
TOMOKA RIVER AT INTERSTATE 95 BRIDGE	21FLA 27010574	FDEP	1985 - 1986	7
TOMOKA RIVER AT STATE ROUTE 40 BRIDGE	21FLA 27010578	FDEP	1985 - 2009	11
TOMOKA RIVER AT ELEVENTH STREET BRIDGE	21FLA 27010579	FDEP	1985 - 1998	9
TOMOKA RIVER AT RIVER BEND PARK	21FLA 27010923	FDEP	2009	5
TOMOKA RIVER AT LPGA BLVD.	21FLA 27010924	FDEP	2009	5
TOMOKA RIVER @ 1-4	21FLCEN 27010075	FDEP	2005	1
TOMOKA RIVER AT INTERSTATE 95 BRIDGE	21FLCEN 27010574	FDEP	2005	1
TOMOKA RIVER AT 11TH STREET BRIDGE	21FLCEN 27010579	FDEP	2000 - 2010	11
TOMOKA RIVER AT U.S. HIGHWAY 92	21FLCEN 27010596	FDEP	2000 - 2005	3
TOMOKA RIVER AT SR 40 (TOMOKA ROAD)	21FLCEN 27010830	FDEP	2005	4
TOMOKA RIVER AT U.S. HIGHWAY 92	21FLGW 34921	FDEP	2008	1
SJ7-LR-2003 TOMOKA RIVER	21FLGW 34929	FDEP	2008	1
SJ7-LR-2004 TOMOKA RIVER	21FLGW 34930	FDEP	2008	1
SJ7-LR-2009 TOMOKA RIVER	21FLGW 34931	FDEP	2008	1
SJ7-LR-2010 TOMOKA RIVER	21FLGW 34932	FDEP	2008	1
SJ7-LR-2015 TOMOKA RIVER	21FLGW 34933	FDEP	2008	1
SJ7-LR-2017 TOMOKA RIVER	21FLGW 34934	FDEP	2008	1
SJ7-LR-2019 TOMOKA RIVER	21FLGW 34935	FDEP	2008	1
SJ7-LR-2024 TOMOKA RIVER	21FLGW 34936	FDEP	2008	1
SJ7-LR-2029 TOMOKA RIVER	21FLGW 34937	FDEP	2008	1
SJ7-LR-2032 TOMOKA RIVER	21FLGW 34938	FDEP	2008	1
SJ7-LR-2034 TOMOKA RIVER	21FLGW 34939	FDEP	2008	1
SJ7-LR-2039 TOMOKA RIVER	21FLGW 34940	FDEP	2008	1
SJ7-LR-2040 TOMOKA RIVER	21FLGW 34941	FDEP	2008	1
SJ7-LR-2043 TOMOKA RIVER	21FLGW 34942	FDEP	2008	1
SJ7-LR-2044 TOMOKA RIVER	21FLGW 34943	FDEP	2008	1
SJ7-LR-2049 TOMOKA RIVER	21FLGW 34944	FDEP	2008	1

Station	STORET ID	Station Owner	Years With Data	N
SJ7-LR-2050 TOMOKA RIVER	21FLGW 34945	FDEP	2008	1
SJ7-LR-2053 TOMOKA RIVER	21FLGW 34946	FDEP	2008	1
SJ7-LR-2054 TOMOKA RIVER	21FLGW 34947	FDEP	2008	1
SJ7-LR-2055 TOMOKA RIVER	21FLGW 34948	FDEP	2008	1
SJ7-LR-2060 TOMOKA RIVER	21FLGW 34949	FDEP	2008	1
SJ7-LR-2064 TOMOKA RIVER	21FLGW 34950	FDEP	2008	1
SJ7-LR-2069 TOMOKA RIVER	21FLGW 34951	FDEP	2008	1
SJ7-LR-2072 TOMOKA RIVER	21FLGW 34952	FDEP	2008	1
SJ7-LR-2074 TOMOKA RIVER	21FLGW 34953	FDEP	2008	1
SJ7-LR-2080 TOMOKA RIVER	21FLGW 34954	FDEP	2008	1
SJ7-LR-2083 TOMOKA RIVER	21FLGW 34955	FDEP	2008	1
SJ7-LR-2084 TOMOKA RIVER	21FLGW 34956	FDEP	2008	1
SJ7-LR-2089 TOMOKA RIVER	21FLGW 34957	FDEP	2008	1
SJ7-LR-2091 TOMOKA RIVER	21FLGW 34958	FDEP	2008	1
TOMOKA RIVER AT ELEVENTH STREET BRIDGE	21FLGW 3516	FDEP	1998 - 2011	143
TOMOKA RIVER AT 11TH STREET BRIDGE	21FLSJWM27010579	SJRWMD	1995 - 1998	22
TOMOKA RIVER UPSTREAM AT U.S. 92 BRIDGE	21FLSJWMNCBTR05	SJRWMD	2005 - 2006	5
TOMOKA RIVER EAST BRIDGE ON POWERLINE ACCESS NEAR LPGA GOLF	21FLSJWMNCBTR06	SJRWMD	2008 - 2011	42
TOMOKA RIVER @ 11TH STREET BRIDGE	21FLSJWMTR11	SJRWMD	1993 - 1995	10
TOMOKA RIVER UPSTREAM OF S.R. 40 BRIDGE	21FLVEMDTR03	Volusia County	1993 - 1998	54
TOMOKA RIVER UPSTREAM OF 11TH ST. BRIDGE	21FLVEMDTR04	Volusia County	1993 - 1998	51
TOMOKA RIVER UPSTREAM OF U.S. 92 BRIDGE	21FLVEMDTR05	Volusia County	1993 - 1998	30
TOMOKA RIVER FROM UPSTREAM SIDE OF S.R. 40	21FLVEMDVC-077	Volusia County	1999 - 2011	44
TOMOKA RIVER, FROM UPSTREAM SIDE OF LPGA BLVD.	21FLVEMDVC-078	Volusia County	1999 - 2011	37
TOMOKA RIVER FROM UPSTREAM SIDE OF U.S. 92	21FLVEMDVC-079	Volusia County	1999 - 2006	7
TOMOKA RIVER @ 11TH STREET	21FLWPB 20010739	FDEP	2003	6
TOMOKA RIVER @ STATE HIGHWAY 40	21FLWPB 20010740	FDEP	2003	6
TOMOKA RIVER AT CR216A (WBID 2634)	21FLWQSPVOL358LR	FDEP	2005	3

Table 5.2. Statistical Summary of Historical CHLAC Data for Tomoka River

Station	N	Minimum	Maximum	Median	Mean
CANAL TO TOMOKA @ 265 CHEROKEE RD	5	2.8	9.2	7.5	6.1
TOMOKA RIVER BETWEEN AIRPORT DITCH AND ISLAND	7	1.2	39.9	4.5	11.6
TOMOKA RIVER EAST FORK AROUND ISLAND	7	1.0	84.3	4.3	15.1
TOMOKA RIVER AT INTERSTATE 95 BRIDGE	7	1.0	18.9	1.4	6.6
TOMOKA RIVER AT STATE ROUTE 40 BRIDGE	11	1.0	20.0	2.0	4.1
TOMOKA RIVER AT ELEVENTH STREET BRIDGE	9	1.0	2.9	1.0	1.5
TOMOKA RIVER AT RIVER BEND PARK	5	8.0	26.0	13.0	15.1
TOMOKA RIVER AT LPGA BLVD.	5	1.0	3.9	1.8	2.2
TOMOKA RIVER @ 1-4	1	2.4	2.4	2.4	2.4
TOMOKA RIVER AT INTERSTATE 95 BRIDGE	1	1.4	1.4	1.4	1.4
TOMOKA RIVER AT 11TH STREET BRIDGE	11	1.0	2.9	1.4	1.5
TOMOKA RIVER AT U.S. HIGHWAY 92	3	2.8	6.2	3.2	4.1
TOMOKA RIVER AT SR 40 (TOMOKA ROAD)	4	1.4	5.6	1.4	2.4
TOMOKA RIVER AT U.S. HIGHWAY 92	1	1.0	1.0	1.0	1.0
SJ7-LR-2003 TOMOKA RIVER	1	28.0	28.0	28.0	28.0
SJ7-LR-2004 TOMOKA RIVER	1	18.0	18.0	18.0	18.0
SJ7-LR-2009 TOMOKA RIVER	1	2.1	2.1	2.1	2.1
SJ7-LR-2010 TOMOKA RIVER	1	9.4	9.4	9.4	9.4
SJ7-LR-2015 TOMOKA RIVER	1	11.0	11.0	11.0	11.0
SJ7-LR-2017 TOMOKA RIVER	1	7.0	7.0	7.0	7.0
SJ7-LR-2019 TOMOKA RIVER	1	23.0	23.0	23.0	23.0
SJ7-LR-2024 TOMOKA RIVER	1	19.0	19.0	19.0	19.0
SJ7-LR-2029 TOMOKA RIVER	1	2.6	2.6	2.6	2.6
SJ7-LR-2032 TOMOKA RIVER	1	22.0	22.0	22.0	22.0
SJ7-LR-2034 TOMOKA RIVER	1	10.0	10.0	10.0	10.0

Station	N	Minimum	Maximum	Median	Mean
SJ7-LR-2039 TOMOKA RIVER	1	19.0	19.0	19.0	19.0
SJ7-LR-2040 TOMOKA RIVER	1	14.0	14.0	14.0	14.0
SJ7-LR-2043 TOMOKA RIVER	1	7.3	7.3	7.3	7.3
SJ7-LR-2044 TOMOKA RIVER	1	17.0	17.0	17.0	17.0
SJ7-LR-2049 TOMOKA RIVER	1	4.4	4.4	4.4	4.4
SJ7-LR-2050 TOMOKA RIVER	1	12.0	12.0	12.0	12.0
SJ7-LR-2053 TOMOKA RIVER	1	10.0	10.0	10.0	10.0
SJ7-LR-2054 TOMOKA RIVER	1	10.0	10.0	10.0	10.0
SJ7-LR-2055 TOMOKA RIVER	1	1.0	1.0	1.0	1.0
SJ7-LR-2060 TOMOKA RIVER	1	15.0	15.0	15.0	15.0
SJ7-LR-2064 TOMOKA RIVER	1	22.0	22.0	22.0	22.0
SJ7-LR-2069 TOMOKA RIVER	1	4.5	4.5	4.5	4.5
SJ7-LR-2072 TOMOKA RIVER	1	120.0	120.0	120.0	120.0
SJ7-LR-2074 TOMOKA RIVER	1	450.0	450.0	450.0	450.0
SJ7-LR-2080 TOMOKA RIVER	1	98.0	98.0	98.0	98.0
SJ7-LR-2083 TOMOKA RIVER	1	65.0	65.0	65.0	65.0
SJ7-LR-2084 TOMOKA RIVER	1	48.0	48.0	48.0	48.0
SJ7-LR-2089 TOMOKA RIVER	1	49.0	49.0	49.0	49.0
SJ7-LR-2091 TOMOKA RIVER	1	210.0	210.0	210.0	210.0
TOMOKA RIVER AT ELEVENTH STREET BRIDGE	143	1.0	7.7	1.0	1.3
TOMOKA RIVER AT 11TH STREET BRIDGE	22	1.0	5.6	1.0	1.7
TOMOKA RIVER UPSTREAM AT U.S. 92 BRIDGE	5	1.0	1.3	1.1	1.1
TOMOKA RIVER EAST BRIDGE ON POWERLINE ACCESS NEAR LPGA GOLF	42	1.0	356.8	1.2	13.7
TOMOKA RIVER @ 11TH STREET BRIDGE	10	1.0	6.2	1.5	2.1
TOMOKA RIVER UPSTREAM OF S.R. 40 BRIDGE	54	1.0	36.6	1.1	5.3

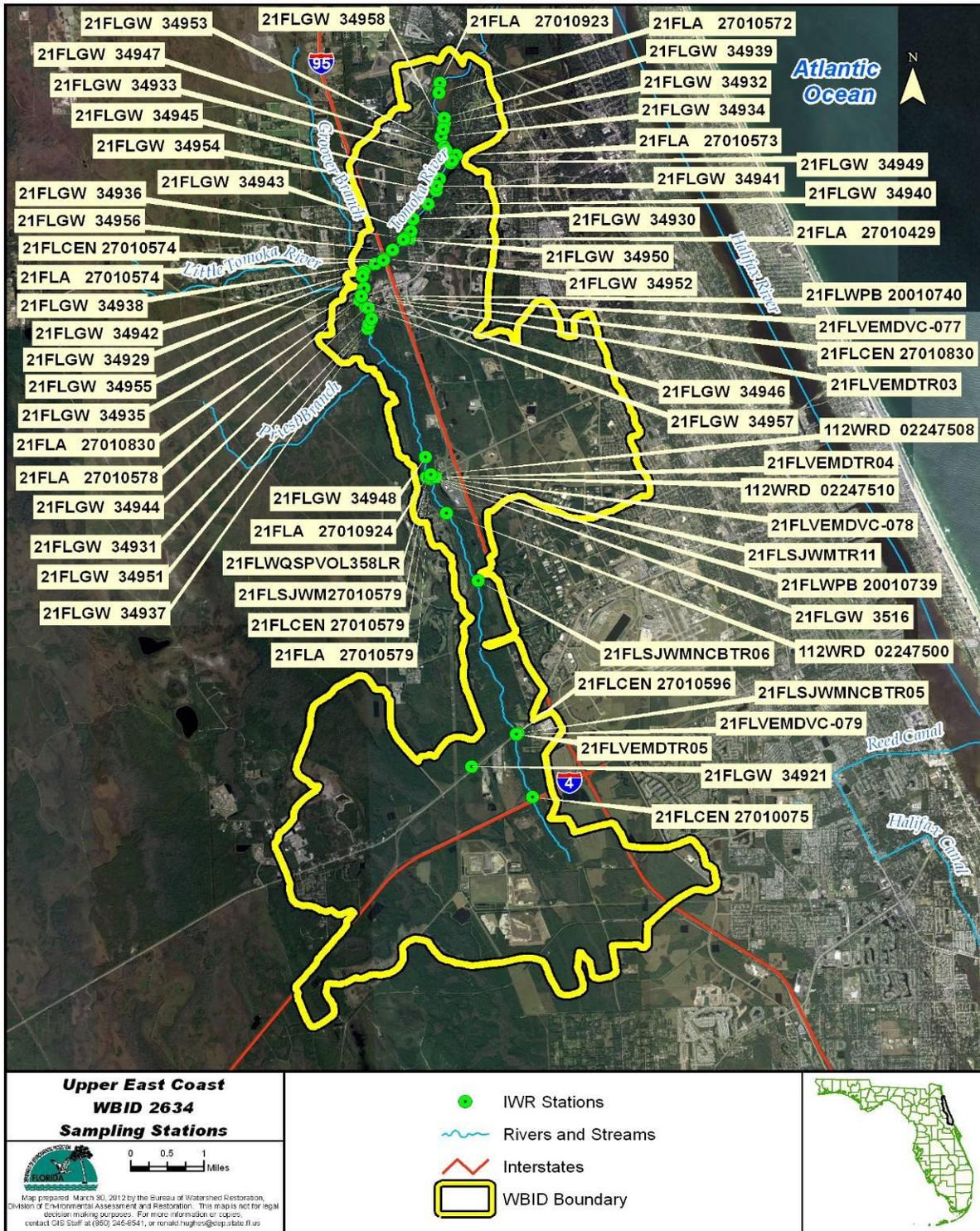
Station	N	Minimum	Maximum	Median	Mean
TOMOKA RIVER UPSTREAM OF 11TH ST. BRIDGE	51	1.0	4.2	1.0	1.2
TOMOKA RIVER UPSTREAM OF U.S. 92 BRIDGE	30	1.0	17.3	1.4	3.0
TOMOKA RIVER FROM UPSTREAM SIDE OF S.R. 40	44	1.0	51.3	2.0	7.6
TOMOKA RIVER, FROM UPSTREAM SIDE OF LPGA BLVD.	37	0.5	3.7	1.0	1.3
TOMOKA RIVER FROM UPSTREAM SIDE OF U.S. 92	7	1.0	9.9	1.7	3.8
TOMOKA RIVER @ 11TH STREET	6	1.0	2.0	1.0	1.2
TOMOKA RIVER @ STATE HIGHWAY 40	6	1.0	18.6	3.5	7.3
TOMOKA RIVER AT CR216A (WBID 2634)	3	1.0	1.1	1.0	1.0

CHLAC concentrations are ug/L.

Table 5.3. Summary statistics for Major Water Quality Parameters Measured in Tomoka River

PARAMETER	N	MIN	25%	MEDIAN	MEAN	75%	MAX
BOD (mg/L)	71	0.4	0.8	1.4	1.7	2.0	6.1
CHLAC (ug/L)	567	0.5	1.0	1.1	6.2	2.8	450.0
COLOR (PT-CO)	604	5	84	170	239	340	1200
COND (uS/cm)	628	0	163	300	4104	462	76100
DO (mg/L)	632	0.00	3.30	4.60	4.59	5.87	19.19
DOSAT (%)	243	0.00	38.65	53.90	51.99	66.00	133.00
NH4 (mg/L)	312	0.001	0.018	0.028	0.060	0.047	1.500
NO3O2 (mg/L)	581	0.000	0.020	0.039	0.053	0.062	0.640
PH (su)	664	4.13	6.73	7.03	6.96	7.30	8.43
SALINITY (ppt)	517	0.00	0.10	0.15	2.51	0.23	24.13
SD (m)	495	0.0	0.4	0.6	0.7	0.8	25.0
TEMP (°C)	672	5.90	17.73	22.03	21.46	25.52	35.00
TN (mg/L)	527	0.03	0.78	1.00	1.13	1.31	4.52
TP (mg/L)	563	0.010	0.036	0.050	0.108	0.090	1.880
TSS (mg/L)	492	0	2	4	4	4	55
TURBIDITY (NTU)	550	1	2	3	4	4	84
INORGANIC P (mg/L)	406	0.001	0.015	0.023	0.032	0.033	0.457
INORGANIC N (mg/L)	304	0.01	0.05	0.08	0.12	0.11	1.52
TN/TP RATIO	521	0.00	12.06	18.53	22.78	28.79	146.40
INORGANICN/INORGANICP	200	0.39	2.26	3.27	5.98	4.99	99.09

Figure 5.1. Historical Sampling Sites in the Tomoka River Watershed



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Figure 5.2. Historical CHLAC Observations for Tomoka River

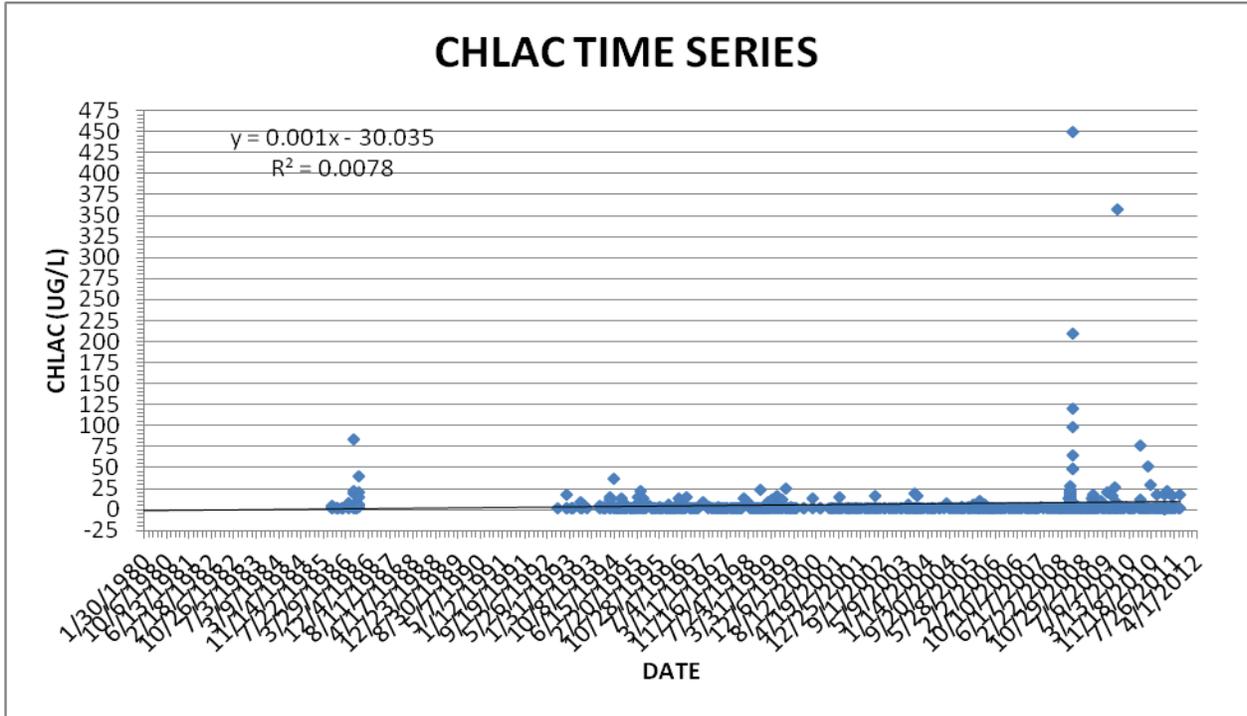


Figure 5.3. Historical TN Observations for Tomoka River

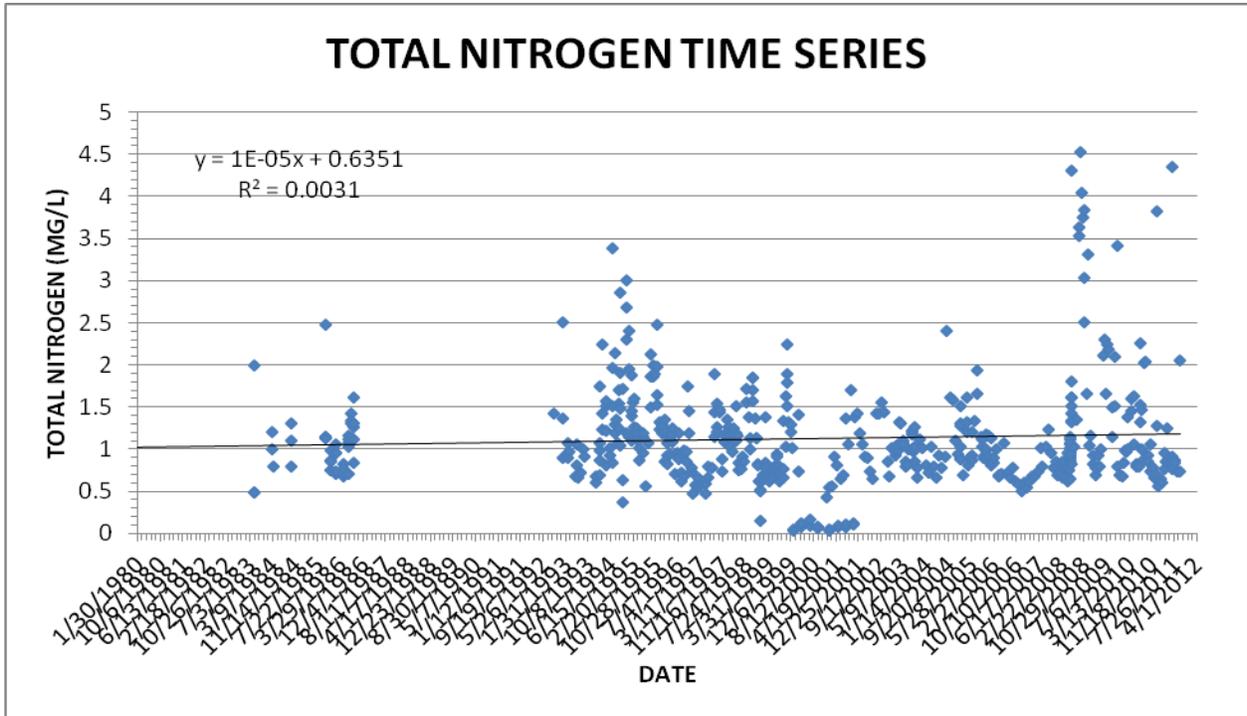


Figure 5.4. Historical TP Observations for Tomoka River

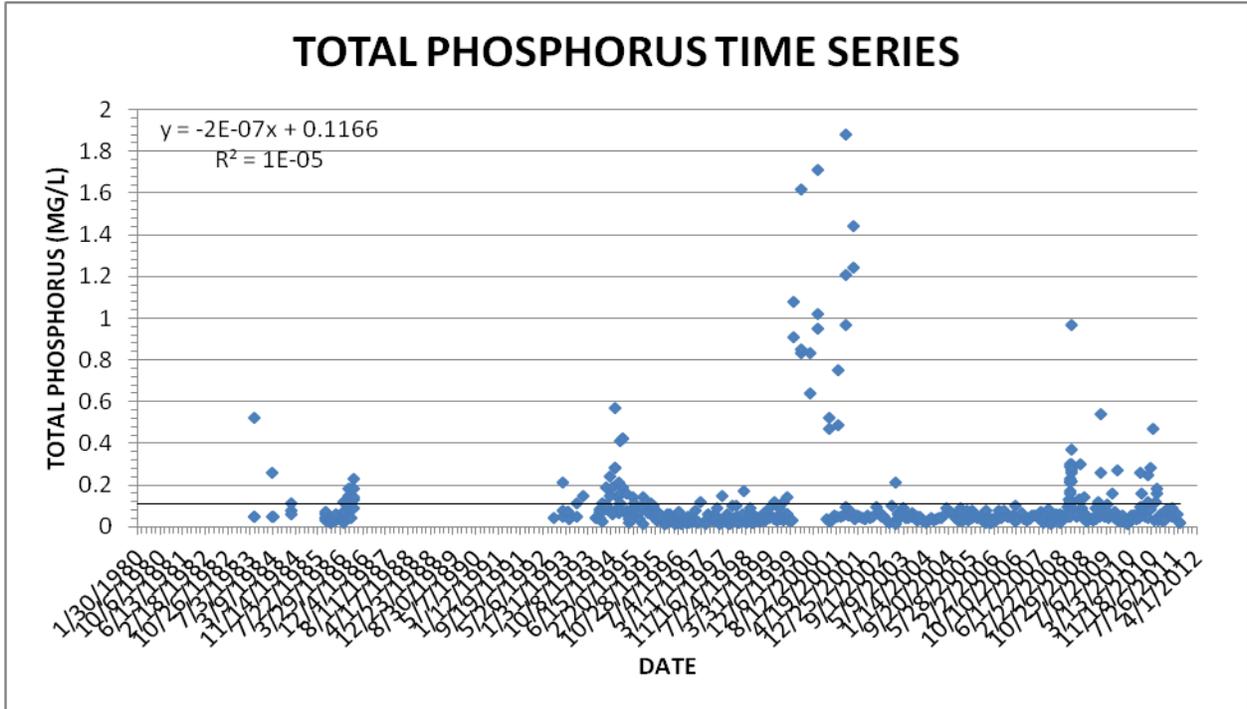


Figure 5.5. Historical Color Observations for Tomoka River

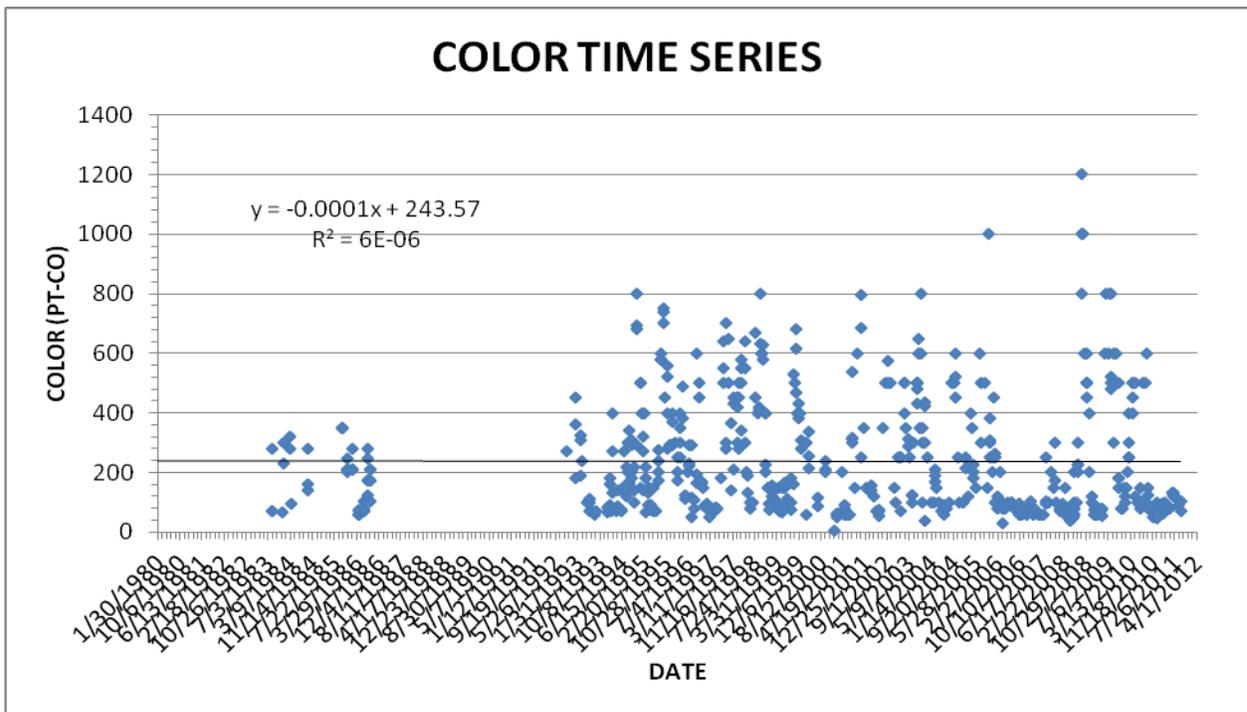
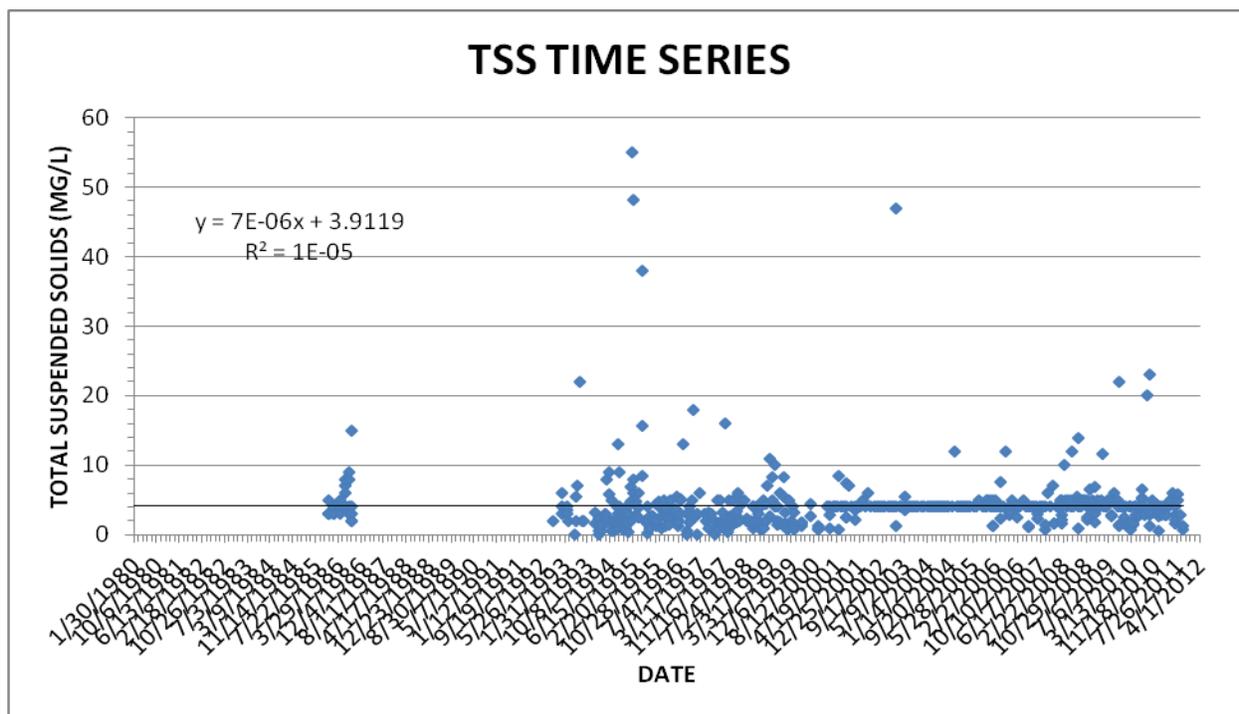


Figure 5.6. Historical Total Suspended Solids Observations for Tomoka River



Available CHLAC, TN, and TP measurements were also summarized by year (Tables 5.4– 5.6). Annual means were based on the IWR methodology that based the average on quarterly averages. A nonparametric test (Kruskal-Wallis) was applied to the CHLAC, INORGN, TN, INORGP, TP, Cond, Color, and TSS datasets to determine whether there were significant differences among seasons (Appendix C). At an α level of 0.05, differences were significant among seasons all the parameters. A similar test for differences among years was significant for all the parameters (Appendix D).

Table 5.4. Statistical Summary of Historical CHLAC Data by Year for Tomoka River

Year	N	Minimum	Maximum	Median	Mean
1985	9	1.0	4.3	1.0	
1986	24	1.0	84.3	4.4	
1992	1	1.0	1.0	1.0	
1993	12	1.0	17.3	1.0	
1994	37	1.0	36.6	1.6	4.3

Year	N	Minimum	Maximum	Median	Mean
1995	34	1.0	22.0	1.0	3.3
1996	33	1.0	15.4	1.0	2.3
1997	21	1.0	8.2	1.0	2.3
1998	35	1.0	23.9	1.0	2.5
1999	35	1.0	25.2	1.1	3.7
2000	10	1.0	13.1	1.1	2.7
2001	21	1.0	14.4	1.0	1.8
2002	16	1.0	16.8	1.0	1.9
2003	24	1.0	18.6	1.0	2.2
2004	15	1.0	7.7	1.0	1.6
2005	36	1.0	9.9	1.4	2.0
2006	17	1.0	1.7	1.0	1.1
2007	16	1.0	2.5	1.0	1.4
2008	64	1.0	450.0	2.4	10.2
2009	50	1.0	356.8	2.6	11.4
2010	33	1.0	76.0	1.3	6.4
2011	24	0.5	21.5	1.3	5.8

CHLAC concentrations are ug/L.

Blank cells in the mean column represent cases where data were not collected in each of the four quarters

Table 5.5 Statistical Summary of Historical TN Data by Year for Tomoka River

Year	N	Minimum	Maximum	Median	Mean
1975	1	0.70	0.70	0.70	
1983	3	0.49	2.00	0.49	
1984	6	0.80	1.30	1.05	1.43
1985	10	0.75	2.48	1.06	1.46

Draft TMDL Report Tomoka River, WBID 2634, Nutrients

Year	N	Minimum	Maximum	Median	Mean
1986	25	0.67	1.61	1.06	1.01
1992	1	1.42	1.42	1.42	0.92
1993	14	0.66	2.50	0.93	1.17
1994	39	0.37	3.38	1.29	0.93
1995	34	0.56	2.47	1.36	0.22
1996	34	0.47	1.75	0.96	0.58
1997	22	0.48	1.90	0.98	1.07
1998	35	0.62	1.85	1.13	1.00
1999	35	0.15	2.24	0.78	1.11
2000	12	0.03	1.40	0.09	1.13
2001	21	0.03	1.70	0.54	0.75
2002	12	0.65	1.56	0.98	0.81
2003	28	0.67	1.32	1.02	1.91
2004	12	0.66	2.40	0.92	1.40
2005	31	0.69	1.94	1.03	1.13
2006	15	0.50	1.13	0.73	1.19
2007	12	0.54	1.24	0.76	1.43
2008	55	0.61	4.52	0.97	1.46
2009	21	0.69	3.42	1.14	1.01
2010	27	0.66	2.25	1.00	0.92
2011	22	0.56	4.36	0.83	1.17

TN concentrations are mg/L.

Blank cells in the mean column represent cases where data were not collected in each of the four quarters

Table 5.6. Statistical Summary of Historical TP Data by Year for Tomoka River

Year	N	Minimum	Maximum	Median	Mean
1968	1	0.130	0.130	0.130	
1969	1	0.114	0.114	0.114	
1970	1	0.068	0.068	0.068	
1971	1	0.117	0.117	0.117	
1975	1	0.090	0.090	0.090	
1983	3	0.050	0.520	0.050	
1984	6	0.050	0.260	0.070	
1985	10	0.020	0.070	0.030	
1986	25	0.020	0.230	0.090	
1992	1	0.040	0.040	0.040	
1993	10	0.034	0.210	0.070	
1994	39	0.025	0.570	0.085	0.144
1995	34	0.015	0.140	0.069	0.072
1996	34	0.010	0.070	0.030	0.032
1997	22	0.010	0.150	0.031	0.047
1998	37	0.010	0.170	0.040	0.048
1999	35	0.023	0.140	0.040	0.053
2000	10	0.640	1.710	0.930	1.014
2001	21	0.024	1.880	0.069	0.443
2002	12	0.019	0.093	0.047	0.048
2003	29	0.010	0.210	0.052	0.057
2004	12	0.020	0.091	0.042	0.047
2005	31	0.020	0.091	0.045	0.050
2006	22	0.020	0.100	0.044	0.049

Year	N	Minimum	Maximum	Median	Mean
2007	18	0.010	0.081	0.042	0.043
2008	62	0.020	0.970	0.110	0.100
2009	30	0.028	0.540	0.050	0.093
2010	33	0.010	0.470	0.048	0.084
2011	22	0.020	0.180	0.057	0.057

TP concentrations are mg/L.

Blank cells in the mean column represent cases where data were not collected in each of the four quarters

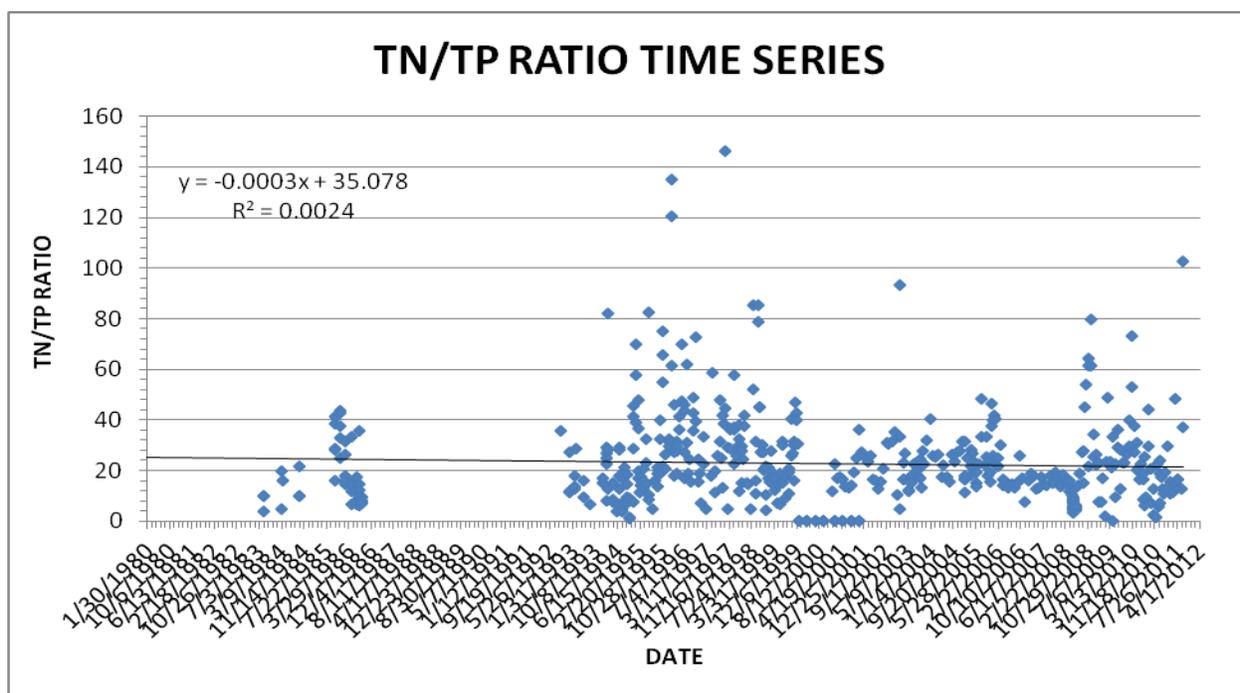
5.1.2 TMDL Development Process

As part of evaluating potential relationships between CHLAC and other variables, rainfall records for the Daytona International Airport (**Appendix J**) were used to determine rainfall amounts associated with individual sampling dates. Rainfall recorded on the day of sampling (PRECIP), the cumulative total for the day of and the previous two days (V3DAY), the cumulative total for the day of and the previous six days (V7DAY), the cumulative total for the day of and the previous thirteen days (V14DAY), and the cumulative total for the day of and the previous twenty days (V21DAY) were all paired with the respective water quality parameter observation.

A Spearman correlation matrix was used to assess potential relationships between CHLAC and other water quality parameters (**Appendix G**). At an alpha (α) level of 0.05, correlations between CHLAC, COND, SALINITY, water temperature (TEMP), TN, TP, TSS, TURBIDITY, and V21DAY were significant. A simple linear regression of CHLAC versus SALINITY explained nearly 11 percent of the variance in CHLAC while the regression with TN explained 8 percent of the variance in CHLAC (**Appendix H**).

The impairment listing identified TN and TP as co-limiting nutrients. **Figure 5.7** illustrates the time series of the TN/TP ratio. Although the trendline indicates a decline in the TN/TP ratio, the regression was not significant at an alpha (α) level of 0.05. A similar plot of the INORGN/INORGP ratio had a slope of 0.00007. Summary statistics for the ratio's can be found in **Table 5.3**. Based on the INORGN/INORGP ratio, it appeared that inorganic forms of nitrogen were typically limiting compared to inorganic phosphorus (75% value was 4.99).

Figure 5.7. Historical Time Series of the TN/TP Ratio for the Tomoka



Since the impairment for nutrients was based on an annual average for CHLAC, annual averages for water quality parameters were also calculated using available data and linear regressions were performed. The calculations of annual averages followed the methodology described in the IWR for the calculation of annual CHLAC averages.

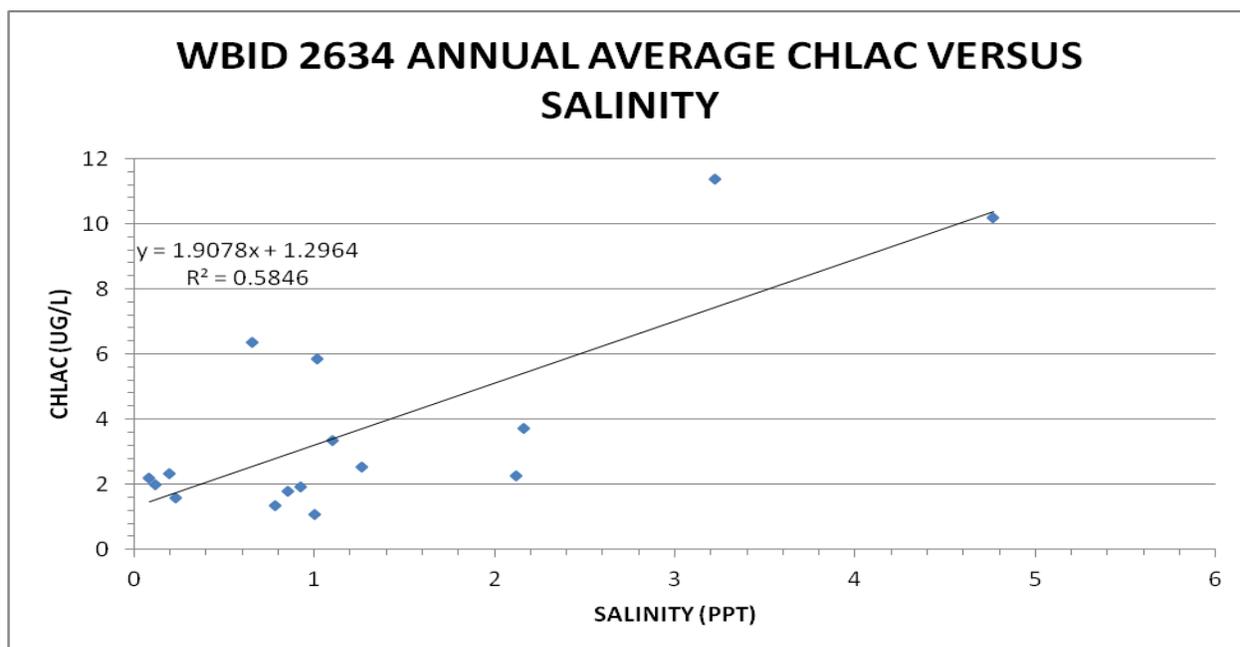
Based on simple linear regression using annual averages, correlations between CHLAC and COND, NH₄, NO₃O₂, SALINITY, TEMPC, TN, and INORGN were significant at an alpha (α) level of 0.05 (**Appendix I**). Approximately 59 percent of the variance in the annual average CHLAC was explained with the annual average SALINITY concentration. Annual average NH₄ explained nearly 43 percent (INORGN explained 42 percent) of the variance in the annual average CHLAC concentrations. Water temperature and TN explained 24 percent and 41 percent of the variance, respectively. Neither INORGP nor TP regressions with CHLAC were significant at an alpha (α) level of 0.05. Simple linear regressions with annual average CHLAC concentrations versus the model predicted annual average TN and TP watershed loads (**Table 4.5**) were not significant at an alpha (α) level of 0.05 (**Appendix I**).

Although the regression between CHLAC and annual rainfall was not significant ($r^2 = 0.044$, $p=0.406$), annual rainfall patterns were examined further to evaluate whether there were cumulative effects due to reduced rainfall. Annual rainfall totals over the 1937 through 2011 were ranked (**Appendix J**). With the exception of 2009 (50.3 inches), rainfall totals over the 2008 – 2011 period were below the long-term annual average of 49.63 inches. To evaluate the longer term effects of below average rainfall years, an annual rainfall deficit was calculated

based on the long-term average. The cumulative effect of deficits was calculated by summing over a three year (current year and two previous years) and a five year (current year and the four previous years) period. Simple linear regressions of the annual average CHLAC versus the three-year cumulative and five-year cumulative deficits were significant at an alpha (α) level of 0.05 (**Appendix I**). Plots of the annual rainfall deficit and cumulative three and five-year deficits can be found in **Appendix J**. As seen in the plots, following the high rainfall in 2005 (65.77 inches), the cumulative three and five-year deficits increased sharply.

In fourteen of the sixteen years for which annual averages for salinity were calculated, the annual average salinity was below 2.7 ppt and represented fresh water conditions. In those fourteen years, the maximum annual average CHLAC concentration was 6.4 ug/L with twelve of the years averaging less than 3.7 ug/L. For the two years where the annual average salinity exceeded 3 ppt (2008 and 2009), annual average CHLAC concentrations were between 10.2 and 11.ug/L. The annual average CHLAC concentration in 2010 was 6.4 ug/L and the annual average salinity was 0.7 ppt. This is illustrated by **Figure 5.8**.

Figure 5.8. Annual Average CHLA versus Salinity for the Tomoka



As discussed in Section 5.1.1, thirty-three of the fifty-eight stations with CHLAC had only one observation. Patterns of CHLAC, SALINITY, TN, and TP were further explored at three long-term stations that were sampled over the 1998 – 2011 period. The following plots (**Figures 5.9 – 5.12**) illustrate conditions at stations 21FLGW 3516, 21FLVEMDVC-077, and 21FLVEMDVC-078. Stations 21FLVEMDVC-078 and 21FLGW 3516 are located near the LPGA Blvd crossing of the Tomoka River, approximately 2.9 miles south of the 21FLVEMDVC-077 station near SR 40 (**Figure 5.1**). Both CHLAC and SALINITY levels at the 21FLGW 3516 site are elevated

relative to the two sites to the south. Thirty percent of the reported salinity measurements at 21FLVEMDVC-077 represented predominantly marine conditions. Between 30 and 40 percent of the CHLAC observations at this station exceeded 5 ug/L. Approximately 45 percent of the period of record salinity observations reported for stations in the WBID located at or above SR 40 represented predominantly marine conditions, suggesting some tidal transport into this portion of the Tomoka.

Figure 5.9. CHLA Time Series for Three Long-term Stations in the Tomoka

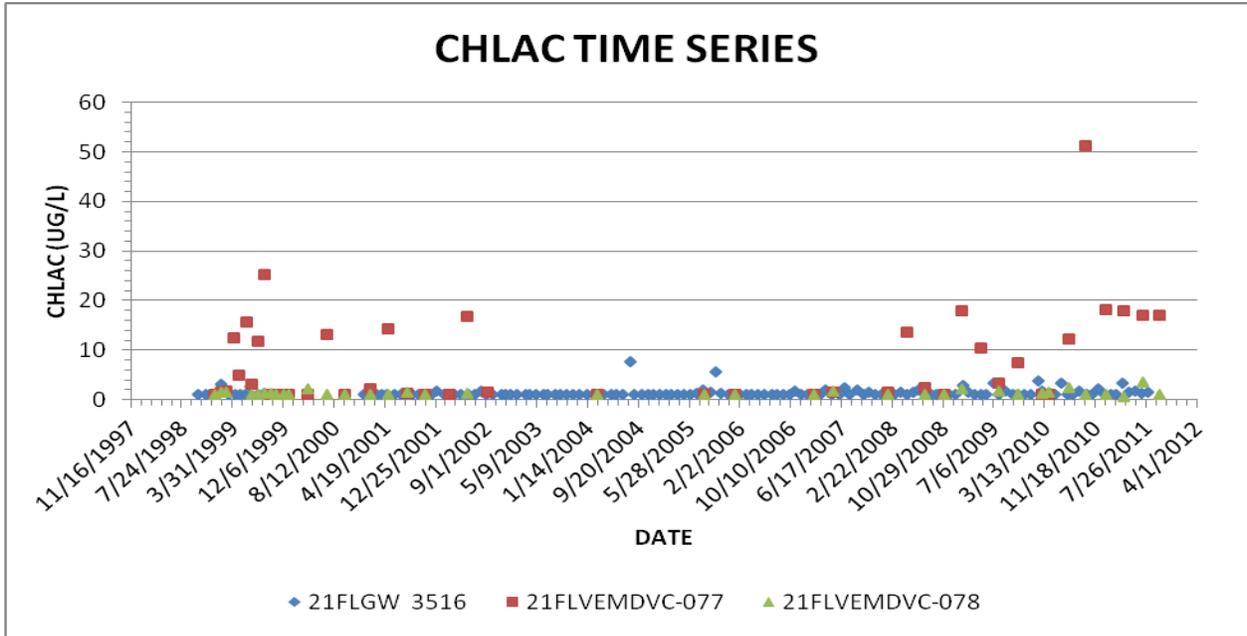


Figure 5.10. Total Nitrogen Time Series for Three Long-term Stations in the Tomoka

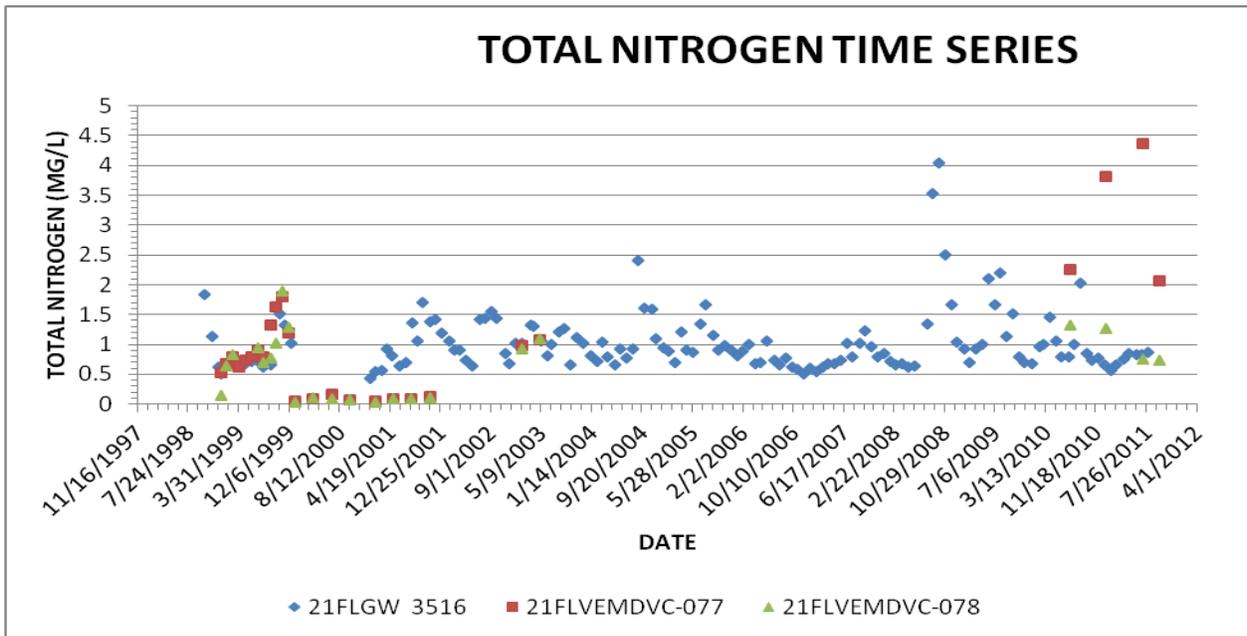


Figure 5.11. Total Phosphorus Time Series for Three Long-term Stations in the Tomoka

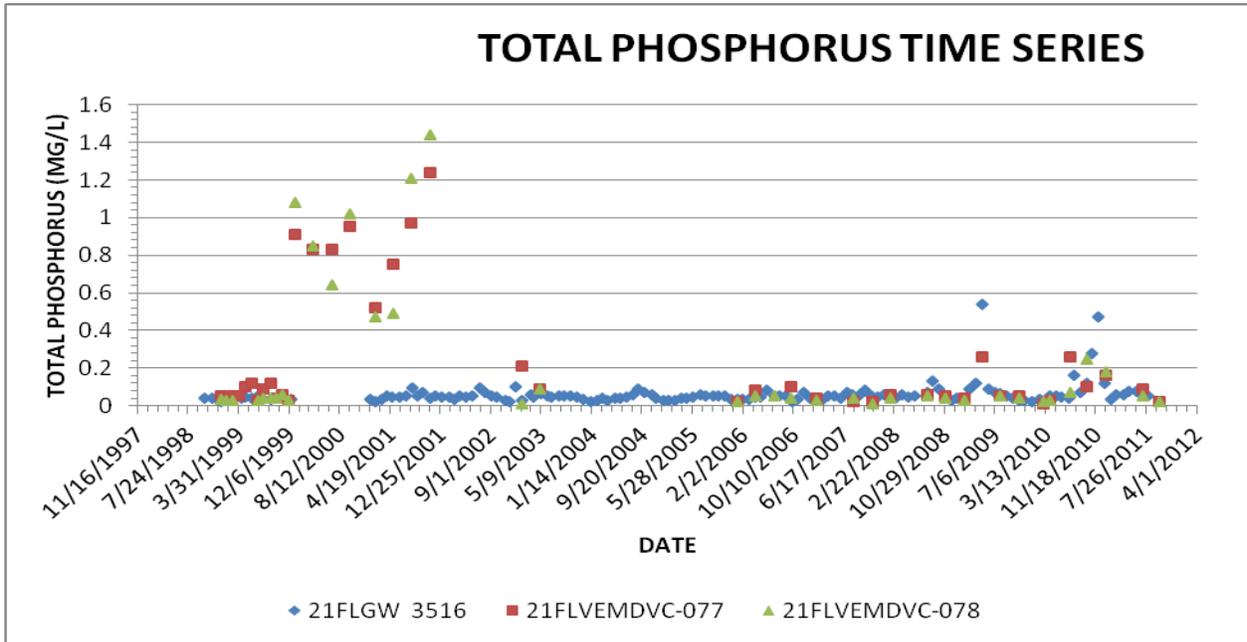
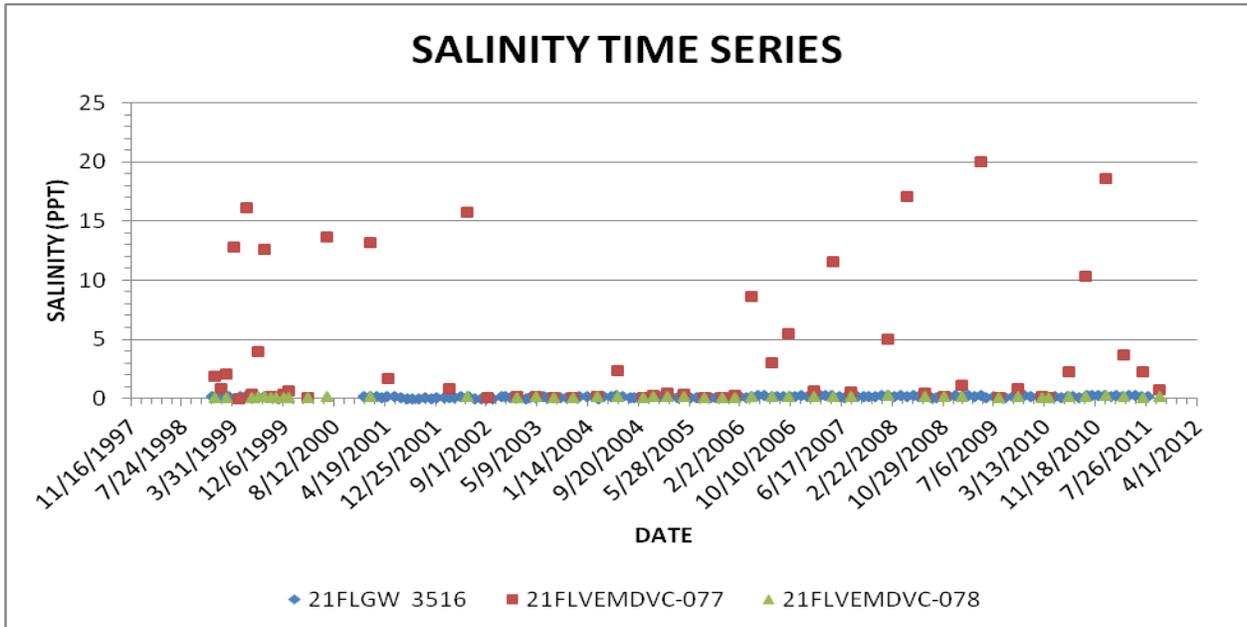


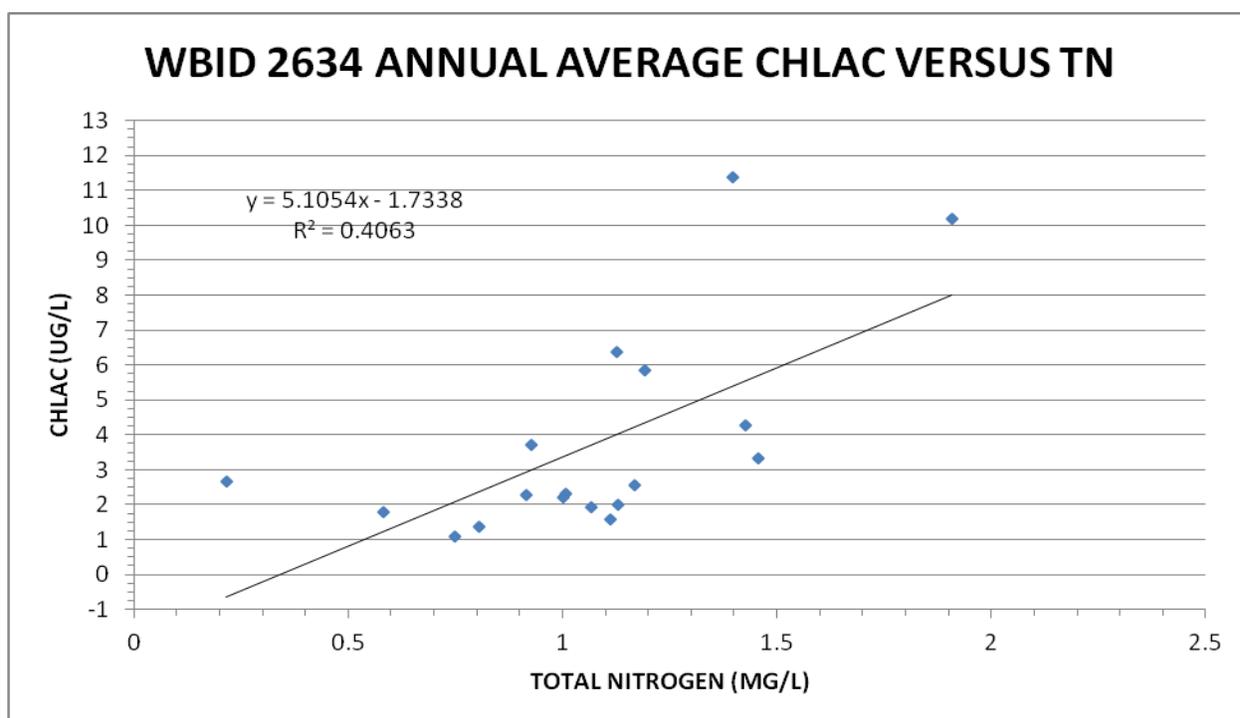
Figure 5.12. Salinity Time Series for Three Long-term Stations in the Tomoka



US EPA ARCHIVE DOCUMENT

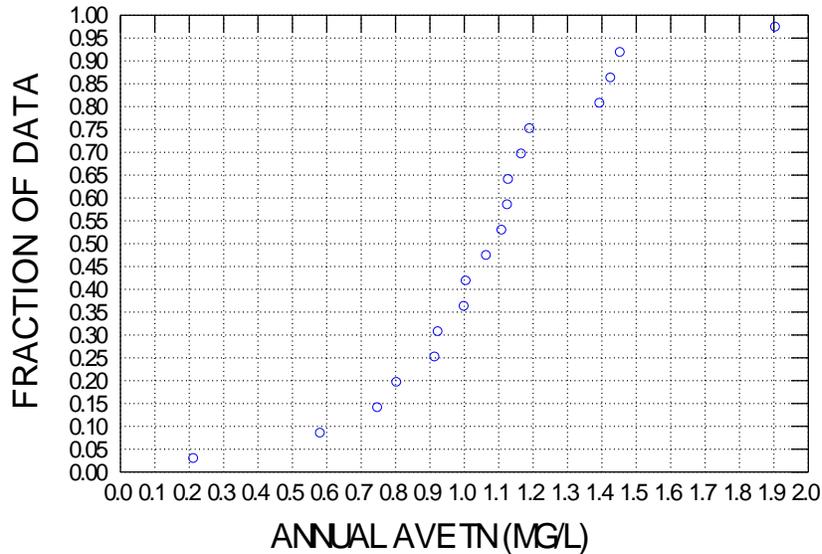
Since the nutrient impairment listing was based on exceeding an annual average CHLA concentration of 5 ug/L for two consecutive years, a target annual average CHLAC concentration of 4.5 ug/l was used to develop nutrient reductions. Correlations between CHLAC inorganic nitrogen (as well as NH4 and NO3O2 individually) and TN were significant. The simple linear regression between annual averages for CHLAC and TN explained nearly 41 percent of the variance in CHLAC (**Figure 5.13**). An annual average TN concentration of 1.22 mg/L would yield a predicted annual average CHLAC concentration of 4.5 ug/L.

Figure 5.13. Regression of Annual Average CHLAC versus TN in the Tomoka



Annual average TN concentrations over the 1994 – 2011 period ranged between 0.22 mg.L (2000) and 1.91 mg/L (2008) with an overall average of 1.07 mg/L. Based on a cumulative frequency plot of annual average TN concentrations (**Figure 5.14**), approximately 78 percent of the annual TN averages were less than 1.22 mg/L. The TMDL requires a 22 percent reduction in the annual average TN concentration to meet an annual average CHLAC target of 4.5 ug/L or lower in the Tomoka watershed.

Figure 5.14 Cumulative Frequency Plot of Annual Average TN in the Tomoka



Estimated watershed TN concentrations and loads were provided by Tetra Tech (**Table 4.5**) for the 1997 – 2009 period. Predicted annual average TN concentrations over the simulation period ranged from 1.10 mg/L to 1.32 mg/L, with an overall average of 1.19 mg/L. Annual TN loadings ranged from 127,797 lbs/yr to 848,249 lbs/yr, with an overall average of 338,774 lbs/yr. A simple linear regression of the model predicted annual average TN concentration versus the predicted annual TN load was not significant at an α level of 0.05, so a TMDL related load associated with a 22 percent reduction in the annual TN concentration was not calculated from the model.

5.1.3 Critical Conditions/Seasonality

Nonparametric tests (Kruskal-Wallis) were presented in **Appendices C** and **D** that illustrated significant differences in CHLAC and nutrients on both a seasonal and annual basis. The nutrient impairment was based on annual average CHLAC concentrations exceeding a historic minimum by 50 percent or more over two consecutive years. The methodology used for calculating an annual average is based on computing individual seasonal averages. Consequently, seasonality is incorporated into the process of assessment and TMDL development. Reductions in TN were based on setting a CHLAC target and corresponding TN concentration below the historic listing threshold.

Chapter 6: DETERMINATION OF THE TMDL

6.1 Expression and Allocation of the TMDL

The objective of a TMDL is to provide a basis for allocating acceptable loads among all of the known pollutant sources in a watershed so that appropriate control measures can be implemented and water quality standards achieved. A TMDL is expressed as the sum of all point source loads (Wasteload Allocations, or WLAs), nonpoint source loads (Load Allocations, or LAs), and an appropriate margin of safety (MOS), which takes into account any uncertainty concerning the relationship between effluent limitations and water quality:

$$\text{TMDL} = \sum \square \text{WLAs} + \sum \square \text{LAs} + \text{MOS}$$

As discussed earlier, the WLA is broken out into separate subcategories for wastewater discharges and stormwater discharges regulated under the NPDES Program:

$$\text{TMDL} \cong \sum \square \text{WLAs}_{\text{wastewater}} + \sum \square \text{WLAs}_{\text{NPDES Stormwater}} + \sum \square \text{LAs} + \text{MOS}$$

It should be noted that the various components of the revised TMDL equation may not sum up to the value of the TMDL because (a) the WLA for NPDES stormwater is typically based on the percent reduction needed for nonpoint sources and is also accounted for within the LA, and (b) TMDL components can be expressed in different terms (for example, the WLA for stormwater is typically expressed as a percent reduction, and the WLA for wastewater is typically expressed as mass per day).

WLAs for stormwater discharges are typically expressed as “percent reduction” because it is very difficult to quantify the loads from MS4s (given the numerous discharge points) and to distinguish loads from MS4s from other nonpoint sources (given the nature of stormwater transport). The permitting of stormwater discharges also differs from the permitting of most wastewater point sources. Because stormwater discharges cannot be centrally collected, monitored, and treated, they are not subject to the same types of effluent limitations as wastewater facilities, and instead are required to meet a performance standard of providing treatment to the “maximum extent practical” through the implementation of BMPs.

This approach is consistent with federal regulations (40 CFR § 130.2[I]), which state that TMDLs can be expressed in terms of mass per time (e.g., pounds per day), toxicity, or **other appropriate measure**. The nutrient TMDL for the Tomoka River is expressed in terms of a percent reduction in total nitrogen nutrient criteria (**Table 6.1**).

Table 6.1. TMDL Components for Tomoka River

WBID	Parameter	TMDL (mg/L)	WLA		LA (% Reduction) ¹	MOS
			Wastewater (mg/L)	NPDES Stormwater (% Reduction) ¹		
2634	TN	1.22	N/A	22%	22%	Implicit

¹ As the TMDL represents a percent reduction, it also complies with EPA requirements to express the TMDL on a daily basis.

6.2 Load Allocation

A total nitrogen reduction of 22 percent is required from nonpoint sources. It should be noted that the load allocation includes loading from stormwater discharges that are not part of the NPDES Stormwater Program.

6.3 Wasteload Allocation

6.3.1 NPDES Wastewater Discharges

There is currently one permitted NPDES discharge in the Tomoka River watershed. Based on discharge monitoring reports, the Tomoka Farms Road Landfill (FL0037877) has an infrequent discharge to the Tomoka River and the reported TN concentrations are below the target concentration.

6.3.2 NPDES Stormwater Discharges

Several Phase II municipal separate storm sewer system (MS4) permits cover portions of the watershed, including permits for the City of Daytona Beach (FLR04E0115) and Volusia County (FLR04E033). The Florida Department of Transportation District 5 is a co-permittee with Volusia County (FLR04E024). It should be noted that any MS4 permittee is only responsible for reducing the loads associated with stormwater outfalls that it owns or otherwise has responsible control over, and it is not responsible for reducing other nonpoint source loads in its jurisdiction.

6.4 Margin of Safety

Consistent with the recommendations of the Allocation Technical Advisory Committee (Department, 2001), an implicit MOS was used in the development of this TMDL. An MOS was included in the TMDL by setting an annual CHLAC target concentration of 4.5 ug/L and applying a 22 percent reduction to annual average TN concentrations. The 22 percent reduction was based on the cumulative frequency of annual averages, but will also result in annual averages below the target concentration of 1.22 mg/L. The overall average over the 1994 – 2011 was 1.07 mg/L and applying a 22 percent reduction to each year would result in a new overall average of 0.83 mg/L.

Chapter 7: NEXT STEPS: IMPLEMENTATION PLAN DEVELOPMENT AND BEYOND

7.1 Basin Management Action Plan

Following the adoption of this TMDL by rule, the Department will determine the best course of action regarding its implementation. Depending upon the pollutant(s) causing the waterbody impairment and the significance of the waterbody, the Department will select the best course of action leading to the development of a plan to restore the waterbody. **Often** this will be accomplished cooperatively with stakeholders by creating a Basin Management Action Plan, referred to as the BMAP. Basin Management Action Plans are the primary mechanism through which TMDLs are implemented in Florida [see Subsection 403.067(7) F.S.]. A single BMAP may provide the conceptual plan for the restoration of one or many impaired waterbodies.

If the Department determines a BMAP is needed to support the implementation of this TMDL, a BMAP will be developed through a transparent stakeholder-driven process intended to result in a plan that is cost-effective, technically feasible, and meets the restoration needs of the applicable waterbodies. Once adopted by order of the Department Secretary, BMAPs are enforceable through wastewater and municipal stormwater permits for point sources and through BMP implementation for nonpoint sources. Among other components, BMAPs typically include:

- Water quality goals (based directly on the TMDL);
- Refined source identification;
- Load reduction requirements for stakeholders (quantitative detailed allocations, if technically feasible);
- A description of the load reduction activities to be undertaken, including structural projects, nonstructural BMPs, and public education and outreach;
- A description of further research, data collection, or source identification needed in order to achieve the TMDL;
- Timetables for implementation;
- Implementation funding mechanisms;
- An evaluation of future increases in pollutant loading due to population growth;
- Implementation milestones, project tracking, water quality monitoring, and adaptive management procedures; and
- Stakeholder statements of commitment (typically a local government resolution).

BMAPs are updated through annual meetings and may be officially revised every five years. Completed BMAPs in the state have improved communication and cooperation among local

stakeholders and state agencies, improved internal communication within local governments, applied high-quality science and local information in managing water resources, clarified obligations of wastewater point source, MS4 and non-MS4 stakeholders in TMDL implementation, enhanced transparency in DEP decision-making, and built strong relationships between DEP and local stakeholders that have benefited other program areas.

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Appendices

Appendix A: Background Information on Federal and State Stormwater Programs

In 1982, Florida became the first state in the country to implement statewide regulations to address the issue of nonpoint source pollution by requiring new development and redevelopment to treat stormwater before it is discharged. The Stormwater Rule, as authorized in Chapter 403, F.S., was established as a technology-based program that relies on the implementation of BMPs that are designed to achieve a specific level of treatment (i.e., performance standards) as set forth in Rule 62-40, F.A.C. In 1994, the Department's stormwater treatment requirements were integrated with the stormwater flood control requirements of the water management districts, along with wetland protection requirements, into the Environmental Resource Permit regulations.

Rule 62-40 also requires the state's water management districts to establish stormwater pollutant load reduction goals (PLRGs) and adopt them as part of a Surface Water Improvement and Management (SWIM) plan, other watershed plan, or rule. Stormwater PLRGs are a major component of the load allocation part of a TMDL. To date, stormwater PLRGs have been established for Tampa Bay, Lake Thonotosassa, the Winter Haven Chain of Lakes, the Everglades, Lake Okeechobee, and Lake Apopka.

In 1987, the U.S. Congress established Section 402(p) as part of the federal Clean Water Act Reauthorization. This section of the law amended the scope of the federal NPDES permitting program to designate certain stormwater discharges as "point sources" of pollution. The EPA promulgated regulations and began implementing the Phase I NPDES stormwater program in 1990. These stormwater discharges include certain discharges that are associated with industrial activities designated by specific standard industrial classification (SIC) codes, construction sites disturbing 5 or more acres of land, and master drainage systems of local governments with a population above 100,000, which are better known as MS4s. However, because the master drainage systems of most local governments in Florida are interconnected, the EPA implemented Phase I of the MS4 permitting program on a countywide basis, which brought in all cities (incorporated areas), Chapter 298 urban water control districts, and the Florida Department of Transportation throughout the 15 counties meeting the population criteria. The Department received authorization to implement the NPDES stormwater program in 2000.

An important difference between the federal NPDES and the state's stormwater/environmental resource permitting programs is that the NPDES Program covers both new and existing discharges, while the state's program focus on new discharges only. Additionally, Phase II of the NPDES Program, implemented in 2003, expands the need for these permits to construction sites between 1 and 5 acres, and to local governments with as few as 1,000 people. While these urban stormwater discharges are now technically referred to as "point sources" for the purpose of regulation, they are still diffuse sources of pollution that cannot be easily collected and treated by a central treatment facility, as are other point sources of pollution such as domestic and industrial wastewater discharges. It should be noted that all MS4 permits issued in Florida include a reopener clause that allows permit revisions to implement TMDLs when the implementation plan is formally adopted.

**Appendix B: Historical Corrected Chla, TEMP, TN, TP, and TSS
Observations in Palm Coast, 1968–2011**

Station	Sample Date	Corr Chla (ug/L)	Temp (°C)	TN (mg/L)	TP (mg/L)	TSS (mg/L)
112WRD 02247510	5/3/1968		26		0.130	
112WRD 02247510	5/1/1969		21		0.114	
112WRD 02247510	5/15/1970		23		0.068	
112WRD 02247510	5/14/1971		25.5		0.117	
112WRD 02247510	11/14/1973		16.5			
112WRD 02247510	1/4/1974		19			
112WRD 02247510	2/22/1974		18.5			
112WRD 02247510	4/19/1974		19.5			
112WRD 02247510	6/19/1974		27			
112WRD 02247510	8/5/1974		24			
21FLA 27010830	3/18/1975		21.2	0.70	0.090	4
112WRD 02247510	10/31/1979		20.5			
112WRD 02247510	1/7/1980		12			
112WRD 02247510	2/20/1980		13			
112WRD 02247510	4/16/1980		17			
112WRD 02247510	6/9/1980		27.5			
112WRD 02247510	8/6/1980		26			
112WRD 02247510	10/1/1980		26.5			
112WRD 02247510	12/2/1980		15			
112WRD 02247510	1/20/1981		8.5			
112WRD 02247510	3/28/1981		19			
112WRD 02247510	5/21/1981		24			
112WRD 02247510	7/10/1981		27			
112WRD 02247510	10/27/1981		24			
112WRD 02247510	12/17/1981		14.5			
112WRD 02247510	2/9/1982		18			
112WRD 02247510	4/13/1982		19.5			
112WRD 02247510	6/7/1982		28			
112WRD 02247510	7/26/1982		25.5			
112WRD 02247510	10/12/1982		22			
112WRD 02247510	1/6/1983		15			
112WRD 02247510	3/9/1983		14.5			

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Station	Sample Date	Corr Chla (ug/L)	Temp (°C)	TN (mg/L)	TP (mg/L)	TSS (mg/L)
112WRD 02247510	3/31/1983		18			
112WRD 02247510	6/16/1983		23.5			
112WRD 02247508	8/18/1983		25.5	0.49	0.050	
112WRD 02247510	8/18/1983			0.49	0.050	
112WRD 02247500	8/18/1983			2.00	0.520	
112WRD 02247508	12/12/1983					
112WRD 02247508	12/21/1983					
112WRD 02247500	12/21/1983					
112WRD 02247500	3/9/1984		13.5	1.20	0.260	
112WRD 02247510	3/9/1984		14.5	1.00	0.050	
112WRD 02247508	3/15/1984		19	0.80	0.050	
112WRD 02247510	9/28/1984			0.80	0.080	
112WRD 02247508	9/28/1984			1.10	0.110	
112WRD 02247500	9/28/1984			1.30	0.060	
21FLA 27010574	10/22/1985	1.4	24.3	1.15	0.030	
21FLA 27010572	10/22/1985	4.3	25.5	1.14	0.040	
21FLA 27010573	10/22/1985	1.0	25.6	1.13	0.040	
21FLA 27010579	10/22/1985		25	2.48	0.060	
21FLA 27010578	10/22/1985	2.6	24	1.13	0.070	
21FLA 27010579	12/16/1985	1.0	12	0.87	0.020	3
21FLA 27010574	12/16/1985	1.0	13.2	0.75	0.020	5
21FLA 27010573	12/16/1985	1.0	15.7	0.85	0.020	3
21FLA 27010578	12/16/1985	1.0	12.8	0.75	0.030	3
21FLA 27010572	12/16/1985	1.2	15.7	0.98	0.030	3
21FLA 27010572	2/11/1986	1.7	19.4	0.95	0.030	3
21FLA 27010579	2/11/1986	1.0	19	1.06	0.040	4
21FLA 27010578	2/11/1986	1.0	19.8	0.71	0.040	3
21FLA 27010574	2/11/1986	1.3	19.2	0.73	0.050	3
21FLA 27010573	2/11/1986	1.3	19.5	0.95	0.060	4
21FLA 27010579	4/28/1986	1.9	23	0.67	0.020	3
21FLA 27010572	4/28/1986	4.5	23.6	0.75	0.050	4
21FLA 27010573	4/28/1986	4.3	25.1	0.71	0.050	4
21FLA 27010574	4/28/1986	7.9	23.9	0.82	0.070	5
21FLA 27010578	4/28/1986	7.7	24	0.77	0.120	4
21FLA 27010579	6/23/1986	1.9	26	0.70	0.040	4

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Station	Sample Date	Corr Chla (ug/L)	Temp (°C)	TN (mg/L)	TP (mg/L)	TSS (mg/L)
21FLA 27010578	6/23/1986		30.3	1.07	0.090	4
21FLA 27010574	6/23/1986	18.9	30.1	1.03	0.130	7
21FLA 27010572	6/23/1986	22.0	28.9	1.12	0.150	6
21FLA 27010573	6/23/1986	84.3	29.5	1.16	0.180	8
21FLA 27010579	7/28/1986	1.0	25.5	1.43	0.040	3
21FLA 27010573	7/28/1986	7.7	28.6	1.30	0.090	8
21FLA 27010574	7/28/1986	1.0	27.5	1.33	0.110	4
21FLA 27010578	7/28/1986	1.1	28	1.13	0.120	3
21FLA 27010572	7/28/1986	7.5	28.9	1.12	0.180	9
21FLA 27010579	8/25/1986	2.9	28	0.84	0.090	15
21FLA 27010573	8/25/1986	6.4	31.6	1.26	0.130	3
21FLA 27010572	8/25/1986	39.9	35	1.11	0.140	2
21FLA 27010578	8/25/1986	20.0	28	1.30	0.180	4
21FLA 27010574	8/25/1986	15.0	29.3	1.61	0.230	2
21FLA 27010579	9/22/1992	1.0	25	1.42	0.040	2
21FLVEMDTR04	1/4/1993	1.0	19.85	1.36	0.050	3
21FLVEMDTR03	1/4/1993	1.0	18.9	0.90	0.080	4
21FLVEMDTR05	1/4/1993	17.3	19.85	2.50	0.210	6
21FLVEMDTR05	3/1/1993	1.0	12.52	1.07	0.060	4
21FLVEMDTR04	3/1/1993	1.0	11.91	0.90	0.070	4
21FLVEMDTR03	3/1/1993	1.0	12.59	0.96	0.070	3
21FLA 27010579	3/16/1993	1.0	13.1	0.97	0.034	2
21FLSJWMTR11	5/19/1993		23.5	0.68		0
21FLVEMDTR04	6/8/1993	1.0	32	0.80	0.050	6
21FLVEMDTR03	6/8/1993	9.2	30	1.06	0.110	2
21FLSJWMTR11	6/16/1993	1.0	25.1	0.66		7
21FLSJWMTR11	7/14/1993	4.3	25.6	0.71		22
21FLA 27010579	8/17/1993	2.2	25	1.00	0.150	2
21FLSJWMTR11	8/25/1993		24.8	0.91		2
21FLVEMDTR04	1/3/1994	1.0	16.235	0.60	0.040	3
21FLVEMDTR03	1/3/1994	4.5	16.53	0.67	0.040	2
21FLVEMDTR04	2/7/1994	1.9	17.75	0.99	0.035	2
21FLVEMDTR03	2/7/1994	1.0	16.3	1.08	0.040	1
21FLVEMDTR05	2/7/1994	3.1	18.3	1.74	0.070	2
21FLSJWMTR11	2/10/1994	1.9	19.1	0.70	0.085	0

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Station	Sample Date	Corr Chla (ug/L)	Temp (°C)	TN (mg/L)	TP (mg/L)	TSS (mg/L)
21FLA 27010579	2/15/1994		15.9	0.86	0.038	2
21FLVEMDTR04	3/7/1994	1.5	16.85	1.24	0.025	2
21FLVEMDTR05	3/7/1994	1.4	17.7	2.24	0.080	1
21FLVEMDTR03	3/7/1994	1.4	17.1	1.43	0.110	2
21FLSJWMTR11	4/20/1994	1.0	22.1	0.80	0.108	3
21FLVEMDTR04	5/2/1994	1.2	23	1.22	0.085	2
21FLVEMDTR03	5/2/1994	15.1	26	1.51	0.100	3
21FLVEMDTR05	5/2/1994	12.0	23	1.58	0.190	8
21FLVEMDTR03	6/6/1994	36.6	29	1.02	0.150	9
21FLVEMDTR04	6/6/1994	1.5	24	0.93	0.240	6
21FLSJWMTR11	6/30/1994	1.0	26.7	0.83	0.065	5
21FLVEMDTR04	7/6/1994	1.0	25	1.51	0.060	2
21FLVEMDTR03	7/6/1994	3.4	25	1.96	0.070	2
21FLVEMDTR05	7/6/1994	2.0	25	3.38	0.190	1
21FLVEMDTR04	8/1/1994	2.6	25	1.29	0.285	2
21FLVEMDTR03	8/1/1994	2.2	26	1.18	0.280	1
21FLVEMDTR05	8/1/1994	1.6	24	2.14	0.570	1
21FLA 27010579	8/23/1994		23.9	1.36	0.083	2
21FLSJWMTR11	8/24/1994	1.1	24.5	1.07	0.139	4
21FLVEMDTR04	9/7/1994	1.4	23	1.25	0.065	13
21FLVEMDTR03	9/7/1994	13.7	26	1.70	0.080	1
21FLVEMDTR05	9/7/1994	2.9	22	1.54	0.210	3
21FLSJWMTR11	9/28/1994	2.1	23.4	1.05	0.112	4
21FLVEMDTR03	10/3/1994	1.0	24	1.48	0.080	3
21FLVEMDTR04	10/3/1994	1.0	24	1.91	0.160	2
21FLVEMDTR05	10/3/1994	8.2	24	2.85	0.410	9
21FLVEMDTR05	11/1/1994	4.3	22	1.71	0.190	4
21FLVEMDTR04	11/1/1994	2.0	22	0.37	0.425	2
21FLVEMDTR03	11/1/1994	1.0	22	0.63	0.420	1
21FLSJWMTR11	12/5/1994	1.0	21.4	3.00	0.066	1
21FLVEMDTR04	12/5/1994	1.0	21	2.68	0.065	2
21FLVEMDTR03	12/5/1994	1.0	21	2.30	0.080	2
21FLVEMDTR05	12/5/1994	1.6	21	1.18	0.160	4
21FLVEMDTR05	1/9/1995	1.0	11	1.15	0.020	0
21FLVEMDTR04	1/9/1995	1.0	10	2.40	0.035	3

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Station	Sample Date	Corr Chla (ug/L)	Temp (°C)	TN (mg/L)	TP (mg/L)	TSS (mg/L)
21FLVEMDTR03	1/9/1995	1.0	13	1.95	0.050	4
21FLA 27010579	1/31/1995		11	1.87	0.039	
21FLVEMDTR05	2/6/1995	5.2	9	1.10	0.030	2
21FLVEMDTR03	2/6/1995	1.0	11	1.40	0.070	5
21FLVEMDTR04	2/6/1995	1.0	9.5	1.45	0.085	7
21FLSJWMTR11	2/20/1995	6.2	16.9	1.55	0.139	55
21FLVEMDTR03	3/6/1995	15.1	18	1.20	0.070	6
21FLVEMDTR05	3/6/1995	8.1	18	1.27	0.090	8
21FLVEMDTR04	3/6/1995	2.4	18	1.60	0.115	48
21FLVEMDTR04	4/3/1995	1.0	15	1.24	0.060	3
21FLVEMDTR03	4/3/1995	22.0	21	1.12	0.070	5
21FLVEMDTR05	4/3/1995	3.0	13	1.19	0.090	4
21FLSJWMTR11	4/24/1995	1.9	24.6	0.87	0.038	6
21FLVEMDTR04	5/1/1995	1.9	22	1.11	0.035	4
21FLVEMDTR03	5/1/1995	13.7	26	1.01	0.070	3
21FLSJWM27010579	6/5/1995	1.0	25.7	0.95	0.093	38
21FLVEMDTR04	6/5/1995	4.2	25	1.14	0.015	16
21FLVEMDTR03	6/5/1995	6.7	29	1.18	0.140	9
21FLVEMDTR03	7/10/1995	4.9	31	0.56	0.120	2
21FLVEMDTR04	8/7/1995	1.0	25			2
21FLVEMDTR03	8/7/1995	1.3	27			0
21FLVEMDTR05	8/7/1995	1.0	25			2
21FLSJWM27010579	8/8/1995	1.0	25.9	1.07	0.067	4
21FLVEMDTR04	9/5/1995	1.0	25.6	2.12	0.100	1
21FLVEMDTR05	9/5/1995	1.0	25.9	1.86	0.100	1
21FLVEMDTR03	9/5/1995	1.0	25.5	1.50	0.110	3
21FLVEMDTR04	10/2/1995		25	1.99	0.050	3
21FLVEMDTR05	10/2/1995		26	1.86	0.100	3
21FLVEMDTR03	10/2/1995		26			2
21FLSJWM27010579	10/10/1995	2.4	26	1.89	0.058	2
21FLVEMDTR04	11/6/1995	1.0	19	1.97	0.030	2
21FLVEMDTR03	11/6/1995	1.0	20	1.64	0.030	1
21FLVEMDTR05	11/6/1995	3.1	19	1.52	0.070	5
21FLSJWM27010579	11/7/1995	1.0	20.7	2.47	0.033	2
21FLVEMDTR04	12/4/1995	1.0	17	1.33	0.050	5

Station	Sample Date	Corr Chla (ug/L)	Temp (°C)	TN (mg/L)	TP (mg/L)	TSS (mg/L)
21FLVEMDTR03	12/4/1995	1.0	17	1.23	0.060	4
21FLVEMDTR04	1/8/1996	1.0	9	1.30	0.040	3
21FLVEMDTR03	1/8/1996	1.0	9	1.26	0.040	4
21FLVEMDTR05	1/8/1996	1.1	10	1.19	0.040	1
21FLSJWM27010579	2/7/1996	5.3	9.8	0.85	0.014	5
21FLVEMDTR04	2/12/1996	1.0	13	1.35	0.010	3
21FLVEMDTR03	2/12/1996	1.0	16	1.21	0.010	1
21FLVEMDTR04	3/4/1996	1.0	13	0.92	0.020	4
21FLVEMDTR03	3/4/1996	1.0	14	0.82	0.030	3
21FLVEMDTR05	3/4/1996	1.7	13	1.07	0.060	4
21FLVEMDTR03	4/1/1996	1.1	19	0.94	0.030	3
21FLVEMDTR04	4/1/1996	1.1	19	1.11	0.040	2
21FLVEMDTR05	4/1/1996	1.0	20	1.13	0.060	1
21FLSJWM27010579	4/9/1996	1.0	16.7	1.18	0.040	5
21FLVEMDTR04	5/6/1996	1.0	22	1.25	0.030	3
21FLVEMDTR03	5/6/1996	4.7	25	1.08	0.030	4
21FLVEMDTR04	6/3/1996	1.1	21	0.70	0.010	3
21FLVEMDTR03	6/3/1996	13.0	24	0.95	0.020	4
21FLSJWM27010579	6/25/1996	1.8	26.8	0.96	0.035	6
21FLVEMDTR04	7/8/1996	1.0	24	0.92	0.020	1
21FLVEMDTR03	7/8/1996	1.0	24	0.87	0.020	2
21FLVEMDTR05	7/8/1996	1.0	24	1.19	0.070	2
21FLVEMDTR04	8/5/1996	1.0	25	0.62	0.010	3
21FLVEMDTR03	8/5/1996	6.4	29	0.94	0.030	5
21FLSJWM27010579	8/7/1996	1.0	27.2	0.72	0.038	5
21FLVEMDTR03	9/3/1996	15.4	24	0.98	0.040	13
21FLA 27010579	9/9/1996		24.09	0.68	0.043	
21FLVEMDTR04	10/7/1996	1.3	23	0.85	0.020	3
21FLVEMDTR05	10/7/1996	1.0	22	0.97	0.020	1
21FLSJWM27010579	10/14/1996	1.2		1.75	0.049	0
21FLVEMDTR04	11/4/1996	1.0	18	1.46	0.020	2
21FLVEMDTR03	11/4/1996	1.0	20	1.19	0.030	4
21FLVEMDTR04	12/2/1996	1.0	17	0.73	0.030	3
21FLVEMDTR03	12/2/1996	1.0	18	0.78	0.050	5
21FLSJWM27010579	12/18/1996	1.0	16.1	0.47	0.025	18

Station	Sample Date	Corr Chla (ug/L)	Temp (°C)	TN (mg/L)	TP (mg/L)	TSS (mg/L)
21FLVEMDTR03	1/6/1997	1.0	19	0.58	0.080	3
21FLVEMDTR03	2/3/1997	5.1	17	0.67	0.020	3
21FLSJWM27010579	2/4/1997		14.6	0.54	0.024	0
21FLVEMDTR03	3/3/1997	8.2	22	0.58	0.120	6
21FLSJWM27010579	4/28/1997	1.0	22	0.48	0.027	3
21FLVEMDTR03	5/5/1997	2.7	22	0.59	0.010	2
21FLSJWM27010579	6/2/1997	2.2	24.1	0.66	0.059	1
21FLVEMDTR03	6/2/1997	1.2	22	0.79	0.040	3
21FLVEMDTR04	7/7/1997	1.0	24	0.77	0.030	3
21FLVEMDTR04	8/4/1997	1.2	25	1.43	0.030	2
21FLVEMDTR05	8/4/1997	1.0	25	1.90	0.060	0
21FLSJWM27010579	8/13/1997	3.1	27.3	1.14	0.046	0
21FLVEMDTR04	9/8/1997	1.0	22	1.26	0.030	2
21FLVEMDTR05	9/8/1997	1.0	22	1.20	0.090	1
21FLSJWM27010579	9/9/1997	2.0	23.5	1.54	0.040	5
21FLSJWM27010579	10/6/1997	1.0	23.1	1.44	0.033	5
21FLVEMDTR04	10/6/1997	1.0	22	1.46	0.010	2
21FLVEMDTR04	11/3/1997	1.0	18	0.87	0.030	2
21FLVEMDTR05	11/3/1997	1.3	19	0.73	0.150	3
21FLSJWM27010579	12/1/1997	1.0	17.5	1.17	0.041	16
21FLVEMDTR04	12/1/1997	1.0	16.9	1.09	0.030	1
21FLVEMDTR03	12/1/1997	1.0	18.7	1.09	0.030	2
21FLVEMDTR03	1/5/1998	1.0	16	1.15	0.020	1
21FLVEMDTR04	1/5/1998	1.0	16	1.09	0.030	1
21FLVEMDTR05	1/5/1998	1.0	17	1.35	0.060	0
21FLSJWM27010579	1/12/1998	1.0	13.8	1.26	0.034	5
21FLVEMDTR03	2/2/1998	1.0	14		0.010	3
21FLVEMDTR04	2/2/1998	1.0	15	1.07	0.040	2
21FLVEMDTR05	2/2/1998	1.0	14	1.03	0.040	1
21FLVEMDTR04	3/2/1998	1.0	16.43	1.14	0.030	2
21FLVEMDTR03	3/2/1998	1.0	16.54	0.98	0.030	2
21FLVEMDTR05	3/2/1998	1.0	17.47	1.20	0.100	1
21FLSJWM27010579	3/3/1998	1.0	14.8	1.24	0.042	5
21FLVEMDTR04	4/6/1998	1.0	17.87	1.18	0.040	2
21FLVEMDTR03	4/6/1998	1.0	20.67	1.10	0.040	3

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Station	Sample Date	Corr Chla (ug/L)	Temp (°C)	TN (mg/L)	TP (mg/L)	TSS (mg/L)
21FLVEMDTR05	4/6/1998	1.0	17.59	1.52	0.100	2
21FLSJWM27010579	4/20/1998	1.0	22.85	1.16	0.048	6
21FLVEMDTR04	5/4/1998	1.4	20.2	0.75	0.020	2
21FLVEMDTR03	5/4/1998	1.0	23.42	0.84	0.020	2
21FLVEMDTR03	6/1/1998	13.1	29.74	0.76	0.050	5
21FLSJWM27010579	6/10/1998	5.6	25.5	0.91	0.062	5
21FLVEMDTR03	7/6/1998	8.7	30.61	0.85	0.170	5
21FLVEMDTR04	8/3/1998	1.0	25.64	1.71	0.020	2
21FLVEMDTR03	8/3/1998	2.9	26.84	1.56	0.030	2
21FLA 27010579	8/31/1998		25.35	1.38	0.044	
21FLVEMDTR04	9/8/1998	1.0	25.46	1.12	0.070	2
21FLVEMDTR03	9/8/1998	1.0	26.54	0.99	0.090	2
21FLVEMDTR04	10/5/1998	1.0	25.36	1.71	0.020	1
21FLVEMDTR03	10/5/1998	1.0	25.29	1.57	0.020	2
21FLGW 3516	10/14/1998	1.0	23.6	1.85	0.041	4
21FLSJWM27010579	10/14/1998	1.0	23.6	1.85	0.041	4
21FLVEMDTR04	11/2/1998	1.0	20.18		0.050	2
21FLVEMDTR03	11/2/1998	1.6	21.32	1.37	0.050	2
21FLGW 3516	11/19/1998	1.0	22.5	1.13	0.038	4
21FLSJWM27010579	11/19/1998		22.5	1.13	0.038	4
21FLVEMDTR04	12/2/1998	1.0	19.75	0.82	0.030	2
21FLVEMDTR03	12/2/1998	23.9	19.72	0.80	0.040	3
21FLGW 3516	12/21/1998	1.0	18.6	0.62	0.030	4
21FLSJWM27010579	12/21/1998	1.0	18.6	0.62	0.030	4
21FLVEMDVC-078	1/4/1999	1.0	12.005	0.15	0.034	1
21FLVEMDVC-077	1/4/1999	1.0	15.01	0.52	0.050	1
21FLGW 3516	1/5/1999	1.0	9.4	0.50	0.023	4
21FLVEMDVC-078	2/1/1999	1.5		0.64	0.030	1
21FLVEMDVC-077	2/1/1999	1.6	18.94	0.69	0.040	1
21FLGW 3516	2/4/1999	3.0	20.5	0.64	0.041	5
21FLVEMDVC-078	3/1/1999	1.5	14.26	0.84	0.030	2
21FLVEMDVC-077	3/1/1999	1.8	16.38	0.78	0.050	2
21FLVEMDVC-079	3/1/1999	8.9		1.38	0.070	4
21FLGW 3516	3/15/1999	1.0	16.3	0.71	0.040	7
21FLVEMDVC-077	4/5/1999	12.4	25.36	0.61	0.050	3

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Station	Sample Date	Corr Chla (ug/L)	Temp (°C)	TN (mg/L)	TP (mg/L)	TSS (mg/L)
21FLGW 3516	4/15/1999	1.0	21.9	0.69	0.042	11
21FLVEMDVC-077	5/3/1999	5.0	18.19	0.73	0.100	8
21FLGW 3516	5/6/1999	1.0	20.5	0.67	0.047	5
21FLGW 3516	6/2/1999	1.0	23.5	0.72	0.038	10
21FLVEMDVC-077	6/7/1999	15.6	28.57	0.79	0.120	4
21FLVEMDVC-078	6/7/1999					
21FLGW 3516	7/1/1999	2.7	21.1	0.74	0.049	4
21FLVEMDVC-078	7/6/1999	1.1	25.33	0.95	0.030	2
21FLVEMDVC-077	7/6/1999	3.2	25.76	0.91	0.030	1
21FLVEMDVC-078	8/2/1999	1.0	27.14	0.70	0.040	2
21FLVEMDVC-077	8/2/1999	11.7	31	0.80	0.090	2
21FLVEMDVC-079	8/2/1999		28.16			
21FLGW 3516	8/4/1999	1.0	25.7	0.62	0.036	6
21FLGW 3516	9/7/1999	1.3	24.3	0.66	0.032	6
21FLVEMDVC-078	9/7/1999	1.3	24.49	0.77	0.040	1
21FLVEMDVC-077	9/7/1999	25.2	29.48	1.33	0.120	8
21FLVEMDVC-079	9/7/1999					
21FLVEMDVC-078	10/4/1999	1.2	24.86	1.03	0.040	2
21FLVEMDVC-077	10/4/1999	1.0	25.07	1.62	0.040	3
21FLVEMDVC-079	10/4/1999		24.82			
21FLGW 3516	10/20/1999	1.1	22.9	1.51	0.056	5
21FLVEMDVC-078	11/1/1999	1.0	22.05	1.89	0.060	1
21FLVEMDVC-077	11/1/1999	1.0	21.9	1.79	0.060	1
21FLVEMDVC-079	11/1/1999	2.6	21.82	2.24	0.140	1
21FLGW 3516	11/15/1999	1.0	18.1	1.32	0.028	5
21FLVEMDVC-078	12/6/1999	1.0	17.12	1.29	0.030	2
21FLVEMDVC-077	12/6/1999	1.0	17.16	1.20	0.030	1
21FLVEMDVC-079	12/6/1999		16.46			
21FLGW 3516	12/16/1999	1.1	16.3	1.01	0.033	4
21FLVEMDVC-077	1/3/2000	1.0	15.06	0.05	0.910	1
21FLVEMDVC-078	1/3/2000	1.0	14.4	0.03	1.080	3
21FLCEN 27010596	3/6/2000			1.40		
21FLCEN 27010579	3/6/2000			0.74		
21FLVEMDVC-077	4/3/2000	1.1	21.18	0.08	0.830	1
21FLVEMDVC-078	4/3/2000	2.1	20.65	0.11	0.850	2

Station	Sample Date	Corr Chla (ug/L)	Temp (°C)	TN (mg/L)	TP (mg/L)	TSS (mg/L)
21FLVEMDVC-079	4/3/2000	1.4	20.93	0.13	1.620	2
21FLVEMDVC-078	7/10/2000	1.0	24.4	0.09	0.640	3
21FLVEMDVC-077	7/10/2000	13.1	31.22	0.17	0.830	4
21FLVEMDVC-077	10/2/2000	1.0	23.32	0.06	0.950	1
21FLVEMDVC-078	10/2/2000	1.2	22.93	0.07	1.020	1
21FLVEMDVC-079	10/2/2000	1.0	22.93	0.08	1.710	1
21FLGW 3516	1/10/2001	1.0	7.3	0.43	0.037	4
21FLVEMDVC-078	2/5/2001	1.0	13.29	0.03	0.470	1
21FLVEMDVC-077	2/5/2001	2.2	17.39	0.05	0.520	3
21FLGW 3516	2/6/2001	1.0	11.2	0.54	0.024	4
21FLGW 3516	3/8/2001	1.0	12.3	0.56	0.033	4
21FLGW 3516	4/3/2001	1.0	15.9	0.92	0.052	4
21FLGW 3516	5/2/2001	1.0	19.8	0.80	0.049	4
21FLVEMDVC-078	5/7/2001	1.0		0.08	0.490	1
21FLVEMDVC-077	5/7/2001	14.4	23.59	0.09	0.750	8
21FLGW 3516	6/6/2001	1.0	24.9	0.65	0.048	4
21FLGW 3516	7/9/2001	1.0	25.4	0.69	0.052	4
21FLVEMDVC-077	8/6/2001	1.2	24.61	0.08	0.970	8
21FLVEMDVC-078	8/6/2001	1.5	24.67	0.08	1.210	3
21FLVEMDVC-079	8/6/2001	1.7	24.6	0.10	1.880	3
21FLGW 3516	8/9/2001	1.2	26	1.36	0.097	4
21FLGW 3516	9/5/2001	1.0	26.1	1.05	0.054	7
21FLGW 3516	10/2/2001	1.0	19.8	1.70	0.069	4
21FLVEMDVC-077	11/5/2001	1.0	22.08	0.12	1.240	4
21FLVEMDVC-078	11/5/2001	1.0	21.09	0.10	1.440	2
21FLGW 3516	11/7/2001	1.0	18.8	1.38	0.038	4
21FLGW 3516	12/4/2001	1.0	19.8	1.42	0.052	4
21FLGW 3516	1/2/2002	1.7	12.4	1.19	0.046	4
21FLGW 3516	2/7/2002	1.0	17.4	1.06	0.045	5
21FLVEMDVC-077	3/4/2002	1.0	16.43			
21FLGW 3516	3/7/2002	1.0	14.3	0.91	0.035	4
21FLGW 3516	4/1/2002	1.0	21.4	0.90	0.054	6
21FLGW 3516	5/2/2002	1.0	22.8	0.73	0.045	4
21FLVEMDVC-077	6/3/2002	16.8	30			
21FLVEMDVC-078	6/3/2002	1.3	24.49			

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Station	Sample Date	Corr Chla (ug/L)	Temp (°C)	TN (mg/L)	TP (mg/L)	TSS (mg/L)
21FLGW 3516	6/4/2002	1.0	25.5	0.65	0.050	4
21FLGW 3516	7/8/2002	1.0	25.4	1.43	0.093	4
21FLGW 3516	8/6/2002	1.7	26.1	1.43	0.069	4
21FLGW 3516	9/5/2002	1.0	25.5	1.56	0.050	4
21FLVEMDVC-077	9/9/2002	1.6	25.83			
21FLGW 3516	10/3/2002	1.0	24.5	1.43	0.047	4
21FLGW 3516	11/14/2002	1.0	17.4	0.85	0.027	4
21FLGW 3516	12/3/2002	1.0	12.2	0.67	0.019	4
21FLGW 3516	1/2/2003	1.0	15.7	1.02	0.100	4
21FLGW 3516	2/3/2003	1.0	14.8	1.03	0.031	4
21FLVEMDVC-078	2/3/2003		12.38	0.93	0.010	1
21FLVEMDVC-077	2/3/2003		13.08	0.98	0.210	47
21FLVEMDVC-079	2/3/2003		11.47			
21FLWPB 20010740	3/12/2003	1.0	19.7	0.99	0.060	
21FLWPB 20010739	3/12/2003	1.0	19.7	1.05	0.063	
21FLGW 3516	3/19/2003	1.0	21.85	1.32	0.057	4
21FLGW 3516	4/3/2003	1.0	18.52	1.31	0.049	4
21FLVEMDVC-077	5/5/2003		26.51	1.07	0.090	6
21FLVEMDVC-078	5/5/2003		23.57	1.10	0.090	4
21FLGW 3516	5/7/2003	1.0	24.5	1.05	0.066	4
21FLWPB 20010740	6/4/2003	5.9	24.9	0.85	0.052	
21FLWPB 20010739	6/4/2003	1.4	23.7	0.79	0.044	
21FLGW 3516	6/10/2003	1.0	25.48	0.80	0.053	4
21FLGW 3516	7/2/2003	1.0	25.3	1.00	0.044	4
21FLVEMDVC-079	8/4/2003		25.47			
21FLVEMDVC-078	8/4/2003		25.56			
21FLVEMDVC-077	8/4/2003		26.56			
21FLGW 3516	8/5/2003	1.0	25.2	1.21	0.054	4
21FLCEN 27010579	8/6/2003		25.08	1.22	0.053	
21FLWPB 20010739	8/13/2003	2.0	25.7	1.18	0.066	
21FLWPB 20010740	8/13/2003	1.1	25.6	1.00	0.050	
21FLWPB 20010739	8/26/2003	1.0	27	0.97	0.048	
21FLWPB 20010740	8/26/2003	18.6	26.12	1.00	0.056	
21FLGW 3516	9/2/2003	1.0	26.4	1.26	0.055	4
21FLWPB 20010739	9/15/2003	1.0	25.3	1.03	0.042	

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Station	Sample Date	Corr Chla (ug/L)	Temp (°C)	TN (mg/L)	TP (mg/L)	TSS (mg/L)
21FLWPB 20010740	9/15/2003	16.3	25.2	0.86	0.051	
21FLGW 3516	10/2/2003	1.0	22.8	0.67	0.050	4
21FLWPB 20010740	10/9/2003	1.0	23.01	0.78	0.028	
21FLWPB 20010739	10/9/2003	1.0	23.17		0.032	
21FLVEMDVC-078	11/3/2003		23.08			
21FLVEMDVC-077	11/3/2003		23.51			
21FLVEMDVC-079	11/3/2003		23.12			
21FLGW 3516	11/4/2003	1.0	24.81	1.11	0.049	4
21FLGW 3516	12/4/2003	1.0	17.96	1.02	0.032	4
21FLGW 3516	1/13/2004	1.0	11.2	0.81	0.020	4
21FLGW 3516	2/10/2004	1.0	17.12	0.72	0.028	4
21FLVEMDVC-078	3/1/2004	1.0	15.12			
21FLVEMDVC-077	3/1/2004	1.0	14.27			
21FLVEMDVC-079	3/1/2004	1.0	15.09			
21FLGW 3516	3/8/2004	1.0	18.8	1.03	0.041	4
21FLGW 3516	4/5/2004	1.0	15.39	0.79	0.030	4
21FLGW 3516	5/10/2004	1.0	20.86	0.66	0.038	4
21FLGW 3516	6/2/2004	1.0	25.76	0.93	0.042	4
21FLVEMDVC-078	6/7/2004		23.34			
21FLVEMDVC-077	6/7/2004		24.14			
21FLGW 3516	7/6/2004	1.0	25.3	0.78	0.045	4
21FLGW 3516	8/9/2004	7.7	26.08	0.92	0.058	4
21FLGW 3516	9/1/2004	1.1	26.67	2.40	0.091	4
21FLGW 3516	10/5/2004	1.1	25.975	1.62	0.069	4
21FLVEMDVC-078	10/11/2004		24.41			
21FLVEMDVC-077	10/11/2004		24.54			
21FLVEMDVC-079	10/11/2004		24.52			
21FLGW 3516	11/8/2004	1.0	19.025	1.59	0.058	12
21FLGW 3516	12/1/2004	1.0	18.51	1.10	0.040	4
21FLVEMDVC-078	12/6/2004		15.96			
21FLVEMDVC-077	12/6/2004		15.17			
21FLGW 3516	1/4/2005	1.0	15.865	0.95	0.030	4
21FLCEN 27010579	1/31/2005	1.4	13.2	0.88	0.079	
21FLCEN 27010596	1/31/2005	3.2	12.7	1.30	0.072	
21FLCEN 27010830	1/31/2005	1.4	15.7	1.03	0.062	

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Station	Sample Date	Corr Chla (ug/L)	Temp (°C)	TN (mg/L)	TP (mg/L)	TSS (mg/L)
21FLCEN 27010075	1/31/2005	2.4	14.8	1.52	0.091	
21FLCEN 27010574	1/31/2005	1.4	15	1.27	0.072	
21FLGW 3516	2/1/2005	1.0	12.23	0.88	0.028	4
21FLVEMDVC-078	2/7/2005		14.99			
21FLVEMDVC-077	2/7/2005		14.35			
21FLGW 3516	3/2/2005	1.0	12.98	0.69	0.028	4
21FLGW 3516	4/4/2005	1.0	16.66	1.21	0.043	4
21FLCEN 27010579	4/7/2005	1.4	20.76	1.32	0.072	
21FLCEN 27010596	4/7/2005	2.8	21.67	1.62	0.075	
21FLCEN 27010075	4/7/2005		21.25			
21FLCEN 27010830	4/7/2005		20.88			
21FLWQSPVOL358LR	4/14/2005		20.02			
21FLWQSPVOL358LR	4/19/2005	1.0	18.01	0.81	0.030	
21FLGW 3516	5/2/2005	1.0	20.505	0.90	0.038	4
21FLVEMDVC-078	5/2/2005		20.49			
21FLVEMDVC-077	5/2/2005		21.19			
21FLVEMDVC-079	5/2/2005		20.46			
21FLCEN 27010596	6/2/2005	6.2	23.8	1.20	0.079	
21FLCEN 27010579	6/2/2005	2.9	23.9	0.93	0.069	
21FLGW 3516	6/2/2005	1.0	23.74	0.87	0.045	4
21FLCEN 27010075	6/2/2005		23.3			
21FLCEN 27010830	6/2/2005		23.8			
21FLGW 3516	7/7/2005	1.2	27.87	1.34	0.059	4
21FLCEN 27010579	7/27/2005	1.5	26.2			
21FLCEN 27010830	7/27/2005	5.6	25.8			
21FLWQSPVOL358LR	7/29/2005		27.46			
21FLGW 3516	8/2/2005	1.9	26.435	1.66	0.050	5
21FLWQSPVOL358LR	8/2/2005	1.0	26.065	1.94	0.040	
21FLVEMDVC-078	8/8/2005	1.0	26			
21FLVEMDVC-077	8/8/2005	1.0	25.5			
21FLVEMDVC-079	8/8/2005	9.9	25.7			
21FLGW 3516	9/12/2005	1.4	25.5	1.15	0.052	4
21FLCEN 27010830	9/21/2005	1.4	25.9	1.12	0.044	
21FLCEN 27010579	9/21/2005	1.4	26	1.03	0.031	
21FLCEN 27010075	9/21/2005		25.7			

Station	Sample Date	Corr Chla (ug/L)	Temp (°C)	TN (mg/L)	TP (mg/L)	TSS (mg/L)
21FLCEN 27010596	9/21/2005		25.81			
21FLGW 3516	10/6/2005	5.6	25.735	0.90	0.050	4
21FLSJWMNCBTR05	10/26/2005	1.0	16.36	0.93	0.038	5
21FLGW 3516	11/2/2005	1.2	19.765	0.99	0.051	4
21FLSJWMNCBTR05	11/7/2005	1.3	21	1.18	0.075	5
21FLVEMDVC-078	11/7/2005		19.96			
21FLVEMDVC-077	11/7/2005		20.09			
21FLVEMDVC-079	11/7/2005		20.46			
21FLCEN 27010830	11/15/2005	1.4	20.9	0.90	0.024	
21FLCEN 27010579	11/15/2005	1.4	19.7	0.99	0.022	
21FLCEN 27010596	11/15/2005		20.1			
21FLSJWMNCBTR05	12/5/2005	1.3	15.93	1.16	0.029	5
21FLGW 3516	12/6/2005	1.0	17.65	0.91	0.035	4
21FLWQSPVOL358LR	12/15/2005		14.42			
21FLWQSPVOL358LR	12/19/2005	1.1	15.37	0.84	0.020	
21FLGW 3516	1/4/2006	1.0	16.52	0.81	0.036	4
21FLSJWMNCBTR05	1/9/2006	1.0	8.63	1.13	0.028	5
21FLVEMDVC-078	1/9/2006	1.0	10.36		0.020	1
21FLVEMDVC-077	1/9/2006	1.0	10.01		0.020	1
21FLVEMDVC-079	1/9/2006		9.46			
21FLSJWMNCBTR05	2/1/2006	1.1	13	0.84	0.039	5
21FLGW 3516	2/1/2006	1.0	12.7	0.89	0.036	4
21FLGW 3516	3/7/2006	1.0	16.04	1.00	0.033	4
21FLCEN 27010579	3/29/2006	1.4	15.2	0.69	0.042	
21FLGW 3516	4/3/2006	1.0	20.145	0.68	0.048	4
21FLVEMDVC-078	4/3/2006		19.51		0.050	2
21FLVEMDVC-077	4/3/2006		21.63		0.080	8
21FLGW 3516	5/1/2006	1.0	19.99	0.70	0.045	4
21FLGW 3516	6/1/2006	1.0	24.97	1.07	0.080	12
21FLGW 3516	7/10/2006	1.0	24.675	0.73	0.050	4
21FLVEMDVC-078	7/10/2006		25.11		0.050	3
21FLVEMDVC-077	7/10/2006		27.37			3
21FLGW 3516	8/2/2006	1.0	26.27	0.67	0.050	5
21FLGW 3516	9/6/2006	1.0	25.55	0.77	0.052	4
21FLVEMDVC-078	10/2/2006		21.94		0.040	3

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Station	Sample Date	Corr Chla (ug/L)	Temp (°C)	TN (mg/L)	TP (mg/L)	TSS (mg/L)
21FLVEMDVC-077	10/2/2006		28.97		0.100	4
21FLGW 3516	10/3/2006	1.0	22.62	0.62	0.024	4
21FLGW 3516	11/2/2006	1.7	20.655	0.58	0.034	4
21FLGW 3516	12/4/2006	1.0	19.79	0.50	0.068	5
21FLGW 3516	1/3/2007	1.0	18.73	0.61	0.038	4
21FLGW 3516	2/1/2007	1.0	14.03	0.54	0.029	4
21FLVEMDVC-078	2/5/2007	1.0	13.03		0.030	1
21FLVEMDVC-077	2/5/2007	1.0	14.12		0.040	1
21FLGW 3516	3/6/2007	1.0	13.87	0.61	0.034	4
21FLGW 3516	4/2/2007	1.9	19.705	0.68	0.053	4
21FLGW 3516	5/3/2007	1.0	21.155	0.67	0.051	4
21FLVEMDVC-078	5/7/2007	1.8	19.6			3
21FLVEMDVC-077	5/7/2007	1.5	24.86			2
21FLGW 3516	6/6/2007	1.1	23.97	0.74	0.043	4
21FLGW 3516	7/5/2007	2.5	25.06	1.02	0.070	4
21FLGW 3516	7/30/2007	1.0	26.195	0.79	0.056	4
21FLVEMDVC-077	8/6/2007		28.33		0.020	1
21FLVEMDVC-078	8/6/2007		26.79		0.040	2
21FLGW 3516	9/5/2007	1.9	25.36	1.03	0.057	6
21FLGW 3516	10/4/2007	1.0	26.31	1.24	0.081	4
21FLGW 3516	11/1/2007	1.4	23.43	0.96	0.050	7
21FLVEMDVC-078	11/5/2007		17.76		0.010	2
21FLVEMDVC-077	11/5/2007		19.65		0.020	2
21FLGW 3516	12/3/2007	1.0	20.11	0.79	0.045	4
21FLGW 3516	1/2/2008	1.0	13.705	0.85	0.061	4
21FLSJWMNCBTR06	1/14/2008	1.0	16.56	0.68	0.039	5
21FLSJWMNCBTR06	2/4/2008	1.0	21.3	0.75	0.041	5
21FLGW 3516	2/4/2008	1.0	18.945	0.71	0.046	4
21FLVEMDVC-TR6	2/4/2008				0.020	2
21FLVEMDVC-078	2/4/2008	1.0	18.09		0.040	3
21FLVEMDVC-077	2/4/2008	1.6	19.31		0.060	2
21FLGW 3516	3/3/2008	1.0	15.11	0.67	0.042	10
21FLSJWMNCBTR06	3/10/2008	1.5	16.98	0.86	0.054	5
21FLGW 3516	4/2/2008	1.5	20.375	0.67	0.056	4
21FLSJWMNCBTR06	4/14/2008	1.0	15.7	0.79	0.049	5

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Station	Sample Date	Corr Chla (ug/L)	Temp (°C)	TN (mg/L)	TP (mg/L)	TSS (mg/L)
21FLSJWMNCBTR06	5/5/2008	13.8	24.4	0.96	0.093	5
21FLVEMDVC-077	5/5/2008	13.7	25.75			
21FLGW 3516	5/6/2008	1.0	20.12	0.61	0.047	4
21FLCEN 27010579	5/20/2008	2.4	23.6	0.75	0.130	12
21FLGW 34940	5/27/2008	19.0	27.57	0.91	0.110	
21FLGW 34950	5/27/2008	22.0	27.88	1.12	0.120	
21FLGW 34949	5/27/2008	15.0	27.145	0.96	0.110	
21FLGW 34941	5/27/2008	14.0	27.63	0.87	0.110	
21FLGW 34943	5/27/2008	17.0	27.84	1.02	0.120	
21FLGW 34930	5/27/2008	18.0	27.87	0.91	0.120	
21FLGW 34945	5/27/2008	12.0	27.39	0.97	0.120	
21FLGW 34933	5/27/2008	11.0	27.055	0.97	0.120	
21FLGW 34939	5/27/2008	10.0	27.335	0.84	0.100	
21FLGW 34947	5/27/2008	10.0	27.295	0.94	0.110	
21FLGW 34932	5/27/2008	9.4	27.395	0.94	0.110	
21FLGW 34934	5/27/2008	7.0	27.145	0.90	0.120	
21FLGW 34938	5/28/2008	22.0	28.035	0.90	0.130	
21FLGW 34936	5/28/2008	19.0	27.875	0.97	0.120	
21FLGW 34929	5/28/2008	28.0	28.255	1.05	0.170	
21FLGW 34942	5/28/2008	7.3	28.035	0.86	0.160	
21FLGW 34935	5/28/2008	23.0	28.33	1.15	0.230	
21FLGW 34946	5/28/2008	10.0	28.195	0.97	0.210	
21FLGW 34944	5/28/2008	4.4	28.37	0.97	0.220	
21FLGW 34937	5/28/2008	2.6	27.155	1.07	0.300	
21FLGW 34931	5/28/2008	2.1	27.055	0.94	0.290	
21FLGW 3516	6/3/2008	1.4	23.825	0.64	0.050	4
21FLGW 34948	6/16/2008	1.0	24.29	0.83	0.082	
21FLGW 34955	6/17/2008	65.0	30.685	1.51	0.270	
21FLGW 34957	6/17/2008	49.0	29.695	1.42	0.300	
21FLGW 34951	6/17/2008	4.5	29.47	1.33	0.260	
21FLGW 34954	6/19/2008	98.0	30.12	1.61	0.290	
21FLGW 34958	6/19/2008	210.0	30.22	1.81	0.370	
21FLGW 34953	6/19/2008	450.0	30.1	4.31	0.970	
21FLGW 34956	6/19/2008	48.0	30.71	1.32	0.220	
21FLGW 34952	6/19/2008	120.0	31.14	1.61	0.280	

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Station	Sample Date	Corr Chla (ug/L)	Temp (°C)	TN (mg/L)	TP (mg/L)	TSS (mg/L)
21FLGW 3516	7/1/2008	2.0	24.01			
21FLSJWMNCBTR06	7/15/2008	5.8	27.24	1.02	0.071	6
21FLGW 3516	8/4/2008	1.0	25.92	1.35	0.071	4
21FLVEMDVC-078	8/4/2008	1.0	25.53		0.050	14
21FLVEMDVC-077	8/4/2008	2.5	26.08		0.060	1
21FLSJWMNCBTR06	8/4/2008	1.0	27.6			5
21FLGW 3516	9/3/2008	1.0	26.78	3.53	0.130	4
21FLSJWMNCBTR06	9/9/2008	1.0	27.55	3.63	0.131	5
21FLGW 34921	9/15/2008	1.0	26.21	4.52	0.300	
21FLGW 3516	9/30/2008	1.0	24.29	4.05	0.090	5
21FLSJWMNCBTR06	10/15/2008	1.0	24.8	3.75	0.070	5
21FLGW 3516	11/3/2008	1.0	19.11	2.51	0.039	4
21FLSJWMNCBTR06	11/3/2008	1.0	20.2	3.84	0.062	5
21FLVEMDVC-078	11/4/2008	1.0	19.41		0.040	2
21FLVEMDVC-077	11/4/2008	1.0	19.84		0.050	3
21FLCEN 27010579	11/6/2008	1.0	18.6	3.04	0.140	4
21FLGW 3516	12/2/2008	1.0	13.76	1.66	0.027	4
21FLSJWMNCBTR06	12/10/2008	1.0	19.18	3.31	0.042	7
21FLGW 3516	12/30/2008	1.0	16.06	1.05	0.041	4
21FLSJWMNCBTR06	1/7/2009	1.0	18.27	1.16	0.034	5
21FLA 27010429FLA	1/13/2009	7.5	18.4			
21FLA 27010924	1/13/2009	1.6	15.8			
21FLA 27010923	1/13/2009	13.0	18.2			
21FLA 27010578	1/13/2009	2.0	17.8			
21FLSJWMNCBTR06	2/2/2009	4.2	14.3	0.82	0.037	3
21FLVEMDVC-078	2/2/2009	2.3	13.77		0.030	2
21FLVEMDVC-077	2/2/2009	17.9	13.43		0.040	7
21FLGW 3516	2/3/2009	2.8	13.395	0.92	0.035	4
21FLA 27010429FLA	2/11/2009	7.7	17.8			
21FLA 27010924	2/11/2009	1.8	14.3			
21FLA 27010923	2/11/2009	8.0	17.3			
21FLA 27010578	2/11/2009	4.1	17.1			
21FLGW 3516	3/4/2009	1.6	12.445	0.70	0.090	4

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Station	Sample Date	Corr Chla (ug/L)	Temp (°C)	TN (mg/L)	TP (mg/L)	TSS (mg/L)
21FLSJWMNCBTR06	3/4/2009	1.0	18.9	0.79	0.034	5
21FLGW 3516	4/1/2009	1.1	19.72	0.92	0.120	4
21FLA 27010429FLA	4/14/2009	9.2	23.93			
21FLA 27010924	4/14/2009	3.9	19.33			
21FLA 27010923	4/14/2009	8.5	23.5			
21FLA 27010578	4/14/2009	3.7	24.01			
21FLSJWMNCBTR06	4/15/2009	2.6	21.1	0.80	0.047	5
21FLVEMDVC-077	5/4/2009	10.5	27		0.260	12
21FLGW 3516	5/5/2009	1.1	22.225	1.00	0.540	4
21FLGW 3516	6/2/2009	1.0	24.935	2.11	0.089	4
21FLSJWMNCBTR06	6/16/2009	1.2	26.39	2.31	0.047	5
21FLGW 3516	7/7/2009	3.3	26.385	1.66	0.071	5
21FLA 27010429FLA	7/15/2009	3.3	26.29			
21FLA 27010924	7/15/2009	2.7	25.37			
21FLA 27010923	7/15/2009	20.0	28.62			
21FLA 27010578	7/15/2009	1.4	25.76			
21FLSJWMNCBTR06	7/20/2009	1.8	25.05	2.25	0.107	5
21FLSJWMNCBTR06	8/3/2009	1.0	27.8		0.044	5
21FLVEMDVC-078	8/3/2009	1.7	27.76		0.050	3
21FLVEMDVC-077	8/3/2009	3.3	26.96		0.050	3
21FLGW 3516	8/4/2009	1.0	26.035	2.19	0.066	5
21FLGW 3516	9/3/2009	1.7	24.74	1.14	0.051	6
21FLSJWMNCBTR06	9/8/2009	16.7	26.4	1.50	0.162	5
21FLSJWMNCBTR06	9/9/2009					
21FLA 27010923	9/16/2009		29.5			
21FLGW 3516	10/6/2009	1.0	24.3	1.51	0.042	5
21FLSJWMNCBTR06	10/7/2009	3.6	25.5	2.10	0.073	4
21FLA 27010429FLA	10/8/2009	2.8	26.9			
21FLA 27010924	10/8/2009	1.0	25.4			
21FLA 27010923	10/8/2009	26.0	28.5			
21FLA 27010578	10/8/2009	1.0	25.2			
21FLSJWMNCBTR06	11/2/2009	356.8	23.4	3.42	0.273	22
21FLVEMDVC-078	11/2/2009	1.0	22.16		0.040	1

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Station	Sample Date	Corr Chla (ug/L)	Temp (°C)	TN (mg/L)	TP (mg/L)	TSS (mg/L)
21FLVEMDVC-077	11/2/2009	7.5	23.03		0.050	1
21FLGW 3516	11/4/2009	1.0	21.045	0.79	0.028	4
21FLGW 3516	12/2/2009	1.0	17.265	0.70	0.030	4
21FLCEN 27010579	12/9/2009	1.1	20.6	0.69	0.030	4
21FLA 27010429FLA	12/9/2009		20.2			
21FLA 27010924	12/9/2009		21.2			
21FLA 27010923	12/9/2009		21.83			
21FLSJWMNCBTR06	12/28/2009	3.2	13.91		0.052	3
21FLGW 3516	1/7/2010	1.0	5.9	0.68	0.025	4
21FLSJWMNCBTR06	1/11/2010	1.0	6.24	0.84	0.032	1
21FLSJWMNCBTR06	2/1/2010	3.0	15.26	0.99	0.025	1
21FLGW 3516	2/10/2010	3.8	12.39	0.97	0.033	4
21FLSJWMNCBTR06	3/1/2010	2.2	14.9	1.38	0.019	1
21FLVEMDVC-077	3/1/2010	1.0	11.53		0.010	1
21FLVEMDVC-078	3/1/2010	1.3	12.27		0.020	1
21FLGW 3516	3/4/2010	1.7	10.655	1.00	0.019	4
21FLSJWMNCBTR06	4/5/2010	1.0	20.9	1.60	0.043	1
21FLVEMDVC-078	4/5/2010	1.6	19.36		0.030	2
21FLVEMDVC-077	4/5/2010	1.0	19.54		0.030	2
21FLGW 3516	4/7/2010	1.3	19.58	1.45	0.053	4
21FLSJWMNCBTR06	5/3/2010	1.0	26.2	1.63	0.053	3
21FLGW 3516	5/4/2010	1.0	24.6	1.05	0.052	4
21FLGW 3516	6/2/2010	3.3	24.71	0.79	0.048	4
21FLSJWMNCBTR06	6/8/2010	2.4	27.76	0.82	0.036	3
21FLGW 3516	7/6/2010	1.0	24.83	0.79	0.042	4
21FLSJWMNCBTR06	7/12/2010	76.0	27.4	1.53	0.092	7
21FLVEMDVC-078	7/12/2010	2.4	26.15	1.32	0.070	5
21FLVEMDVC-077	7/12/2010	12.2	29.87	2.25	0.260	5
21FLGW 3516	8/2/2010	1.0	26.08	1.00	0.160	4
21FLSJWMNCBTR06	8/2/2010	1.9	28.4	1.47	0.058	3
21FLCEN 27010579	8/9/2010	1.0	26.9	0.86	0.093	
21FLGW 3516	9/2/2010	1.8	24.59	2.02	0.068	20
21FLSJWMNCBTR06	9/13/2010	1.0	27.6	2.03	0.046	4
21FLSJWMNCBTR06	10/4/2010	1.0	21.05	0.93	0.045	3

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Station	Sample Date	Corr Chla (ug/L)	Temp (°C)	TN (mg/L)	TP (mg/L)	TSS (mg/L)
21FLVEMDVC-077	10/4/2010	51.3	28.2		0.100	3
21FLVEMDVC-078	10/4/2010	1.0	20.46		0.250	1
21FLGW 3516	10/6/2010	1.0	19.16	0.85	0.120	23
21FLGW 3516	11/2/2010	1.0	20.03	0.74	0.280	4
21FLSJWMNCBTR06	11/3/2010	29.7	23.2	1.06	0.083	5
21FLGW 3516	12/2/2010	2.2	12.755	0.78	0.470	4
21FLSJWMNCBTR06	12/15/2010	1.4	8.8	0.66	0.029	5
21FLGW 3516	1/4/2011	1.0	12.15	0.66	0.120	4
21FLSJWMNCBTR06	1/10/2011	1.0	15.5	0.69	0.036	4
21FLVEMDVC-077	1/10/2011	18.1	15.52	3.82	0.160	3
21FLVEMDVC-078	1/10/2011	1.0	13.39	1.28	0.180	1
21FLGW 3516	2/2/2011	1.1	16.92	0.56	0.032	4
21FLSJWMNCBTR06	2/9/2011	1.1	15.6	0.63	0.050	3
21FLGW 3516	3/2/2011	1.1	18.02	0.65	0.060	4
21FLSJWMNCBTR06	3/16/2011	1.0	17.7	0.60	0.031	3
21FLGW 3516	4/5/2011	3.4	20.48	0.76	0.057	4
21FLSJWMNCBTR06	4/6/2011	1.2	18.1	0.96	0.032	3
21FLVEMDVC-078	4/11/2011	0.5	21.88			
21FLVEMDVC-077	4/11/2011	17.9	24.97			
21FLGW 3516	5/3/2011	1.5	21.68	0.85	0.079	4
21FLSJWMNCBTR06	5/11/2011	21.5	26.7	1.25	0.081	5
21FLGW 3516	6/6/2011	1.7	23.92	0.83	0.074	6
21FLGW 3516	7/5/2011	1.2	26.065	0.83	0.057	4
21FLSJWMNCBTR06	7/11/2011	3.8	27.8	0.91	0.067	3
21FLVEMDVC-078	7/11/2011	3.7	26.09	0.76	0.050	2
21FLVEMDVC-077	7/11/2011	16.9	26.3	4.36	0.090	2
21FLGW 3516	8/3/2011	1.4	25.685	0.86	0.053	5
21FLSJWMNCBTR06	8/3/2011	2.4	28.6	0.84	0.050	6
21FLSJWMNCBTR06	9/7/2011	1.0	26.8	0.74	0.057	3
21FLVEMDVC-078	10/3/2011	1.0	20	0.74	0.020	1
21FLVEMDVC-077	10/3/2011	17.1	26.04	2.06	0.020	1

Appendix C: Kruskal–Wallis Analysis of Corrected Chla, INORGN, TN, INORGP, TP, COND, Color, and TSS, Observations versus Season in Tomoka River

Kruskal-Wallis One-Way Analysis of Variance for 567 cases

Dependent variable is CHLAC

Grouping variable is SEASON\$

Group	Count	Rank Sum
FALL	128	28363.500
SPRING	154	54074.000
SUMMER	139	42451.500
WINTER	146	36139.000

Kruskal-Wallis Test Statistic = 60.589

Probability is 0.000 assuming Chi-square distribution with 3 df

Kruskal-Wallis One-Way Analysis of Variance for 304 cases

Dependent variable is INORGN

Grouping variable is SEASON\$

Group	Count	Rank Sum
FALL	61	9441.500
SPRING	97	14949.000
SUMMER	74	13161.000
WINTER	72	8808.500

Kruskal-Wallis Test Statistic = 14.706

Probability is 0.002 assuming Chi-square distribution with 3 df

Kruskal-Wallis One-Way Analysis of Variance for 527 cases

Dependent variable is TN

Grouping variable is SEASON\$

Group	Count	Rank Sum
FALL	119	36075.000
SPRING	144	32996.500
SUMMER	130	39458.500
WINTER	134	30598.000

Kruskal-Wallis Test Statistic = 31.519

Probability is 0.000 assuming Chi-square distribution with 3 df

Kruskal-Wallis One-Way Analysis of Variance for 406 cases

Dependent variable is INORGP
Grouping variable is SEASON\$

Group	Count	Rank Sum
FALL	96	18733.000
SPRING	96	19948.500
SUMMER	102	27144.000
WINTER	112	16795.500

Kruskal-Wallis Test Statistic = 53.004
Probability is 0.000 assuming Chi-square distribution with 3 df

Kruskal-Wallis One-Way Analysis of Variance for 563 cases
Dependent variable is TP
Grouping variable is SEASON\$

Group	Count	Rank Sum
FALL	132	30977.500
SPRING	151	51180.500
SUMMER	136	45189.000
WINTER	144	31419.000

Kruskal-Wallis Test Statistic = 64.909
Probability is 0.000 assuming Chi-square distribution with 3 df

Kruskal-Wallis One-Way Analysis of Variance for 628 cases
Dependent variable is COND
Grouping variable is SEASON\$

Group	Count	Rank Sum
FALL	155	39154.000
SPRING	172	70746.500
SUMMER	147	39558.500
WINTER	154	48047.000

Kruskal-Wallis Test Statistic = 76.249
Probability is 0.000 assuming Chi-square distribution with 3 df

Kruskal-Wallis One-Way Analysis of Variance for 604 cases
Dependent variable is COLOR
Grouping variable is SEASON\$

Group	Count	Rank Sum
FALL	147	57918.000
SPRING	163	31357.000
SUMMER	146	52255.500
WINTER	148	41179.500

Kruskal-Wallis Test Statistic = 123.064
Probability is 0.000 assuming Chi-square distribution with 3 df

Kruskal-Wallis One-Way Analysis of Variance for 492 cases
Dependent variable is TSS
Grouping variable is SEASON\$

Group	Count	Rank Sum
FALL	123	28286.000
SPRING	114	33077.000
SUMMER	123	30340.000
WINTER	132	29575.000

Kruskal-Wallis Test Statistic = 16.059
Probability is 0.001 assuming Chi-square distribution with 3 df

Appendix D: Kruskal–Wallis Analysis of Corrected Chla, INORGN, TN, INORGP, TP, COND, Color, and TSS Observations versus Year in Tomoka River

Kruskal-Wallis One-Way Analysis of Variance for 567 cases
 Dependent variable is CHLAC
 Grouping variable is YEAR

Group	Count	Rank Sum
1985	9	2200.000
1986	24	9646.000
1992	1	136.500
1993	12	2984.500
1994	37	12550.500
1995	34	9661.000
1996	33	7690.000
1997	21	5326.000
1998	35	6981.500
1999	35	10057.500
2000	10	2525.500
2001	21	4308.500
2002	16	3442.500
2003	24	4998.500
2004	15	2703.500
2005	36	10696.500
2006	17	2913.000
2007	16	3775.500
2008	64	22572.000
2009	50	18419.500
2010	33	9666.000
2011	24	7773.500

Kruskal-Wallis Test Statistic = 97.158
 Probability is 0.000 assuming Chi-square distribution with 21 df

Kruskal-Wallis One-Way Analysis of Variance for 304 cases
Dependent variable is INORGN
Grouping variable is YEAR

Group	Count	Rank Sum
1983	3	352.000
1984	6	1508.000
1993	4	553.000
1994	8	1235.000
1995	7	1658.500
1996	7	1294.000
1997	7	868.500
1998	11	1530.000
1999	12	1417.500
2000	2	240.500
2001	12	1426.500
2002	15	2497.000
2003	26	3292.000
2004	12	2462.000
2005	30	3037.000
2006	15	2149.500
2007	12	1489.000
2008	54	8426.000
2009	21	4039.000
2010	24	4900.000
2011	16	1985.000

Kruskal-Wallis Test Statistic = 53.362
Probability is 0.000 assuming Chi-square distribution with 20 df

Kruskal-Wallis One-Way Analysis of Variance for 527 cases
Dependent variable is TN
Grouping variable is YEAR

Group	Count	Rank Sum
1975	1	95.000
1983	3	542.000
1984	6	1632.000
1985	10	2707.000
1986	25	6490.000
1992	1	421.000
1993	14	3274.000
1994	39	13648.500
1995	34	13290.500
1996	34	8687.000
1997	22	5145.500
1998	35	10907.000
1999	35	7102.500
2000	12	632.000
2001	21	2694.500
2002	12	3201.000
2003	28	7547.500
2004	12	3039.000
2005	31	9109.500
2006	15	2082.500
2007	12	1823.000
2008	55	16306.000
2009	21	6588.000
2010	27	7741.000
2011	22	4422.000

Kruskal-Wallis Test Statistic = 116.680
Probability is 0.000 assuming Chi-square distribution with 24 df

Kruskal-Wallis One-Way Analysis of Variance for 406 cases
Dependent variable is INORGP
Grouping variable is YEAR

Group	Count	Rank Sum
1966	2	492.000
1967	1	406.000
1970	1	366.000
1971	1	397.000
1975	1	170.500
1983	3	491.000
1984	6	1611.500
1993	12	1105.500
1994	37	8860.000
1995	37	7707.500
1996	34	4634.500
1997	22	5439.000
1998	35	8000.500
1999	12	1609.000
2000	2	522.500
2001	12	2922.000
2002	12	3161.500
2003	19	4923.000
2004	22	4378.500
2005	21	3781.000
2006	18	2852.500
2007	16	3785.500
2008	26	5383.000
2009	18	2659.000
2010	20	3023.500
2011	16	3939.000

Kruskal-Wallis Test Statistic = 68.787
Probability is 0.000 assuming Chi-square distribution with 25 df

Kruskal-Wallis One-Way Analysis of Variance for 563 cases
Dependent variable is TP
Grouping variable is YEAR

Group	Count	Rank Sum
1968	1	484.000
1969	1	460.000
1970	1	361.000
1971	1	462.000
1975	1	420.500
1983	3	1082.500
1984	6	2251.000
1985	10	1425.000
1986	25	8990.500
1992	1	179.500
1993	10	3611.500
1994	39	15755.500
1995	34	10413.500
1996	34	4059.000
1997	22	4036.500
1998	37	6878.000
1999	35	7730.500
2000	10	5538.000
2001	21	7926.000
2002	12	2774.000
2003	29	7978.500
2004	12	2590.000
2005	31	7204.000
2006	22	4690.000
2007	18	3580.500
2008	62	24302.500
2009	30	8499.000
2010	33	8668.000
2011	22	6415.000

Kruskal-Wallis Test Statistic = 185.002
Probability is 0.000 assuming Chi-square distribution with 28 df

Kruskal-Wallis One-Way Analysis of Variance for 628 cases
Dependent variable is COND
Grouping variable is YEAR

Group	Count	Rank Sum
1964	2	186.500
1965	9	2609.500
1966	5	557.000
1967	1	449.000
1968	1	479.000
1969	1	368.000
1970	1	310.500
1971	1	315.000
1975	1	548.000
1981	1	385.000
1983	2	435.000
1984	2	514.000
1985	10	2241.000
1986	24	11201.000
1992	1	116.000
1993	14	3868.000
1994	39	13907.000
1995	38	10859.000
1996	32	7355.500
1997	22	5983.000
1998	37	8983.500
1999	36	12142.500
2000	10	2962.000
2001	20	6049.000
2002	16	4523.000
2003	35	6273.000
2004	22	7387.000
2005	32	6150.000
2006	24	6645.000
2007	20	7865.000
2008	61	27701.000
2009	52	18477.500
2010	33	10284.500
2011	23	9376.000

Kruskal-Wallis Test Statistic = 136.820
Probability is 0.000 assuming Chi-square distribution with 33 df

Kruskal-Wallis One-Way Analysis of Variance for 604 cases
Dependent variable is COLOR
Grouping variable is YEAR

Group	Count	Rank Sum
1964	2	697.500
1965	9	2552.000
1966	5	2027.500
1967	1	197.500
1968	1	128.500
1969	1	293.500
1970	1	197.500
1975	1	47.500
1983	6	1445.500
1984	6	1988.500
1985	10	4071.500
1986	25	5929.500
1992	1	401.500
1993	14	3797.500
1994	39	11532.000
1995	38	14169.000
1996	32	11654.500
1997	22	7565.000
1998	37	16690.500
1999	35	10234.500
2000	12	3980.500
2001	21	5684.500
2002	16	4692.000
2003	34	14430.500
2004	20	5884.500
2005	25	10137.500
2006	22	4150.500
2007	18	3343.000
2008	63	11703.500
2009	30	9608.500
2010	33	9859.000
2011	24	3615.000

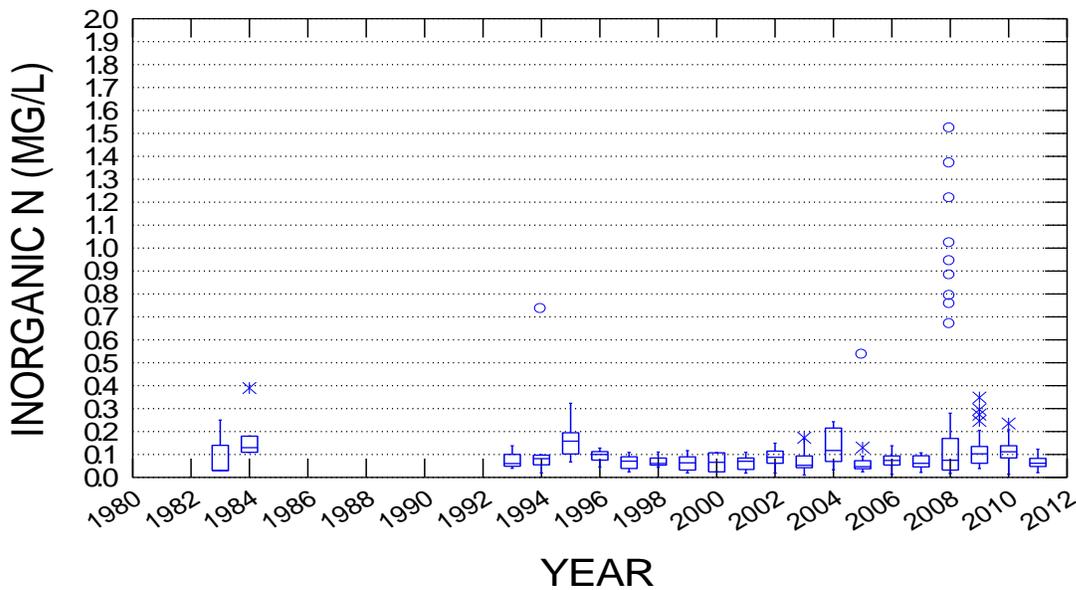
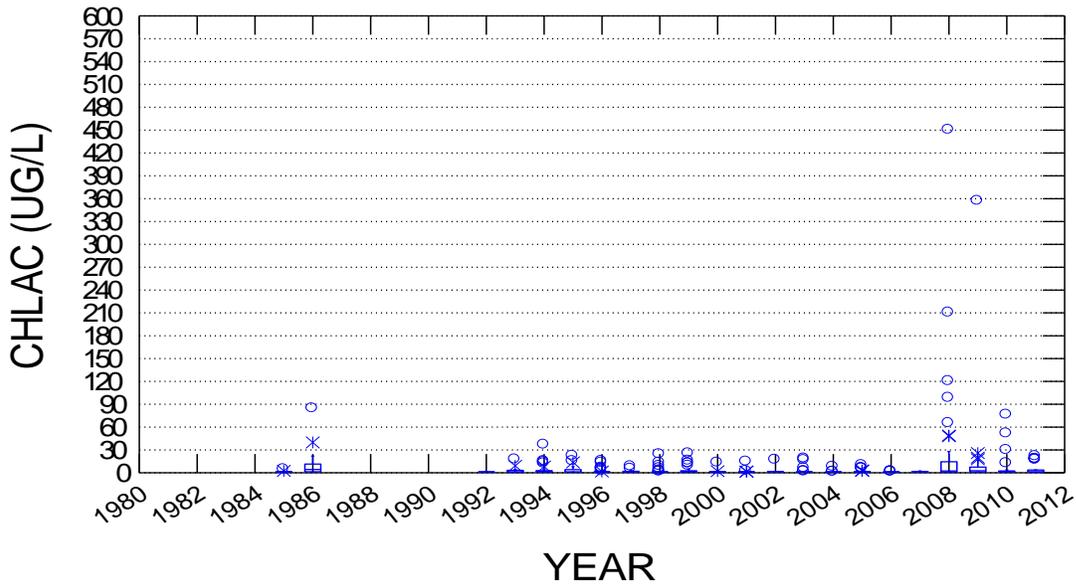
Kruskal-Wallis Test Statistic = 143.774
Probability is 0.000 assuming Chi-square distribution with 31 df

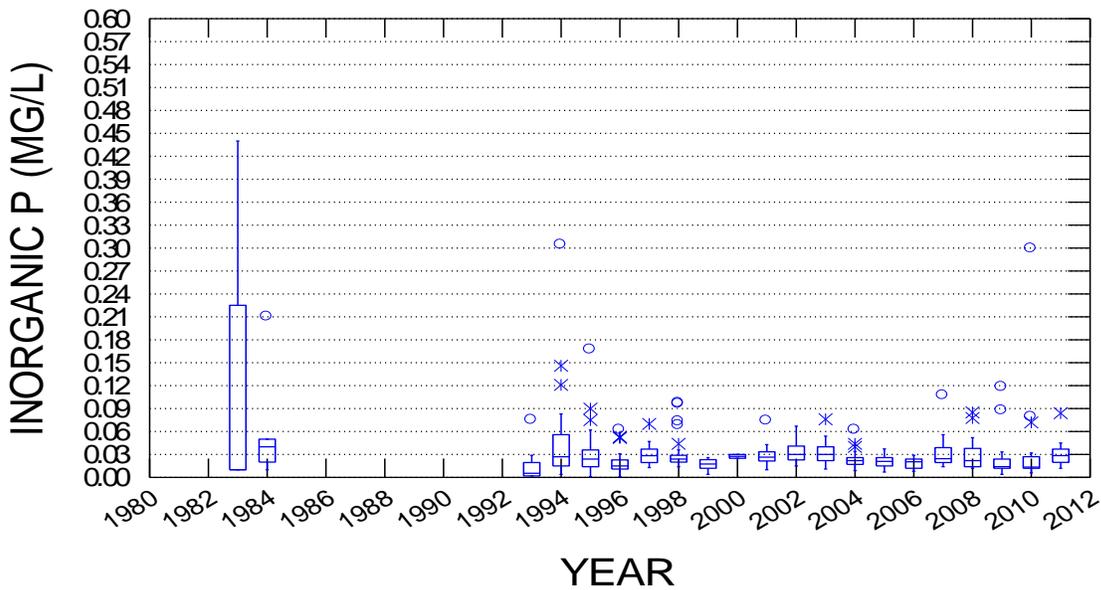
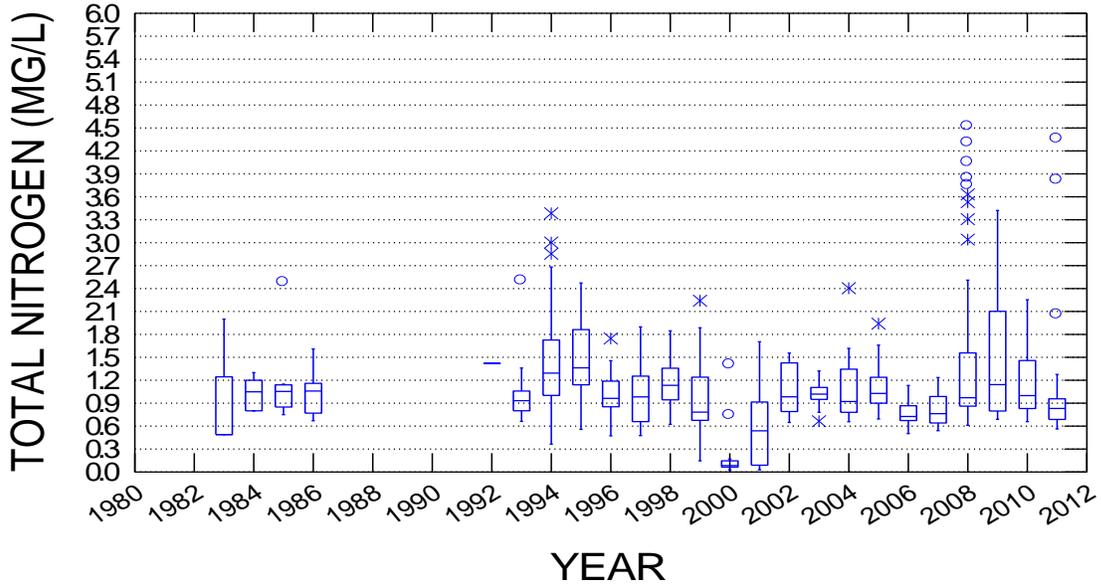
Kruskal-Wallis One-Way Analysis of Variance for 492 cases
Dependent variable is TSS
Grouping variable is YEAR

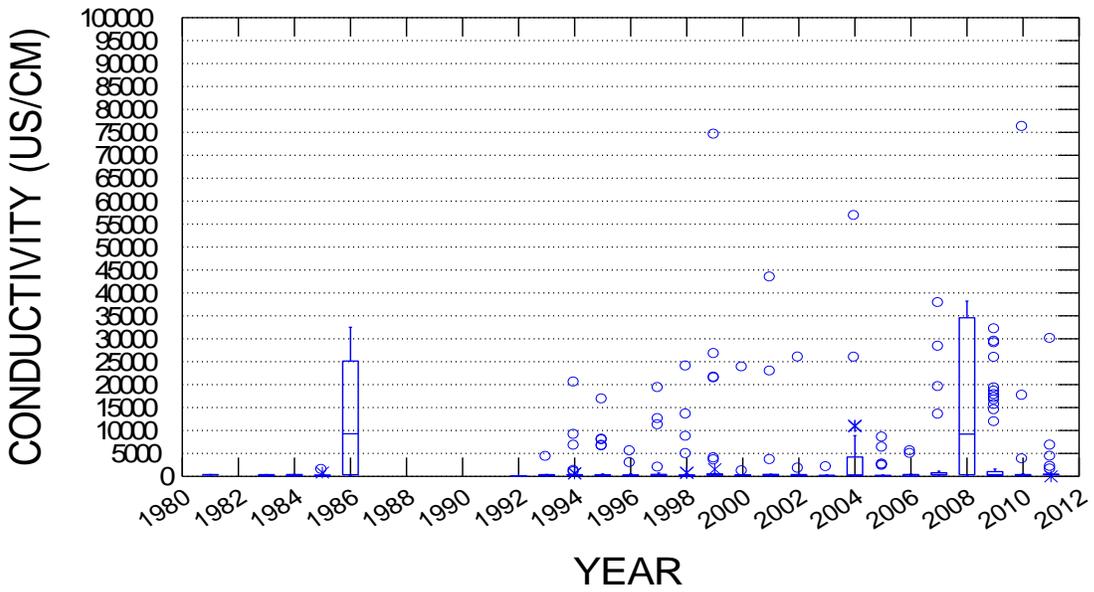
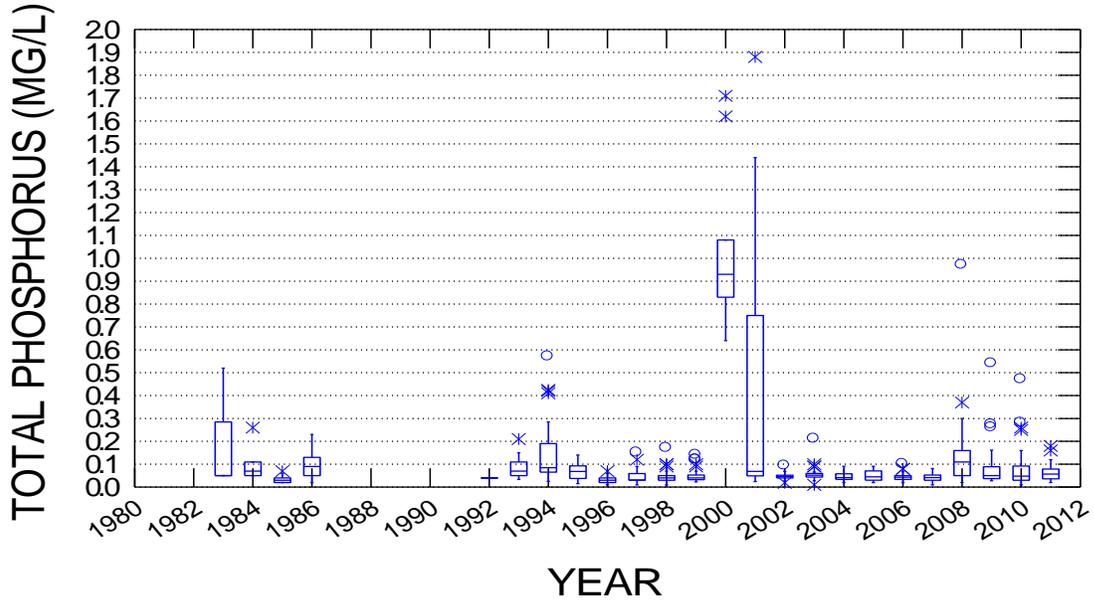
Group	Count	Rank Sum
1975	1	298.500
1985	5	1187.500
1986	25	7471.000
1992	1	119.000
1993	14	3496.500
1994	39	6397.500
1995	37	9371.500
1996	33	7348.500
1997	22	3587.500
1998	36	6709.000
1999	35	7933.500
2000	10	1113.000
2001	21	5547.000
2002	12	3831.500
2003	16	4780.500
2004	12	3759.500
2005	15	4897.500
2006	22	6253.000
2007	20	4578.500
2008	32	10341.000
2009	30	9466.000
2010	32	7757.500
2011	22	5033.000

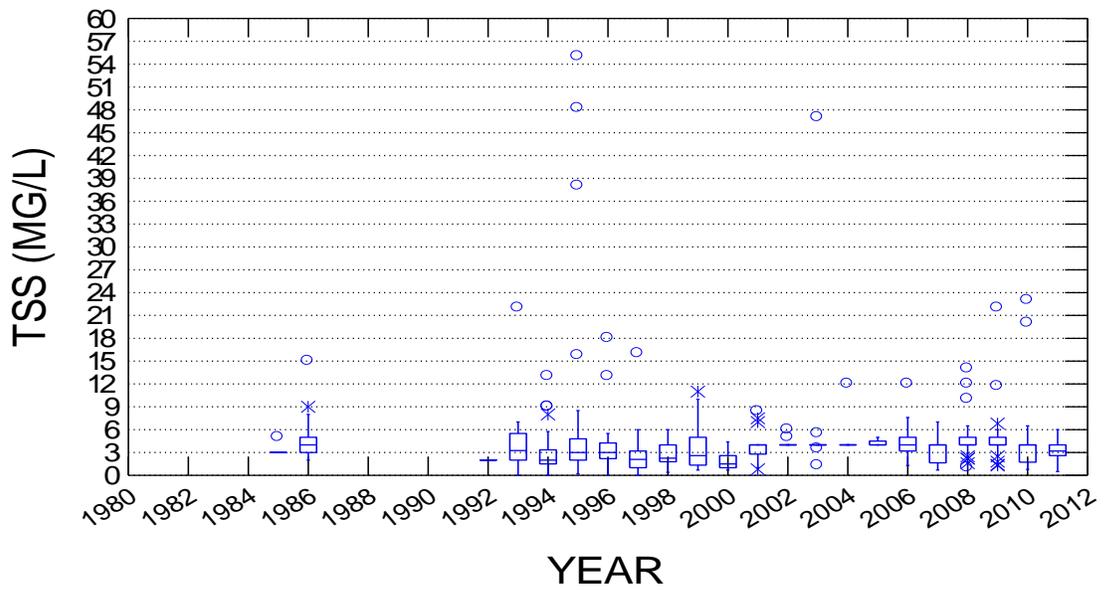
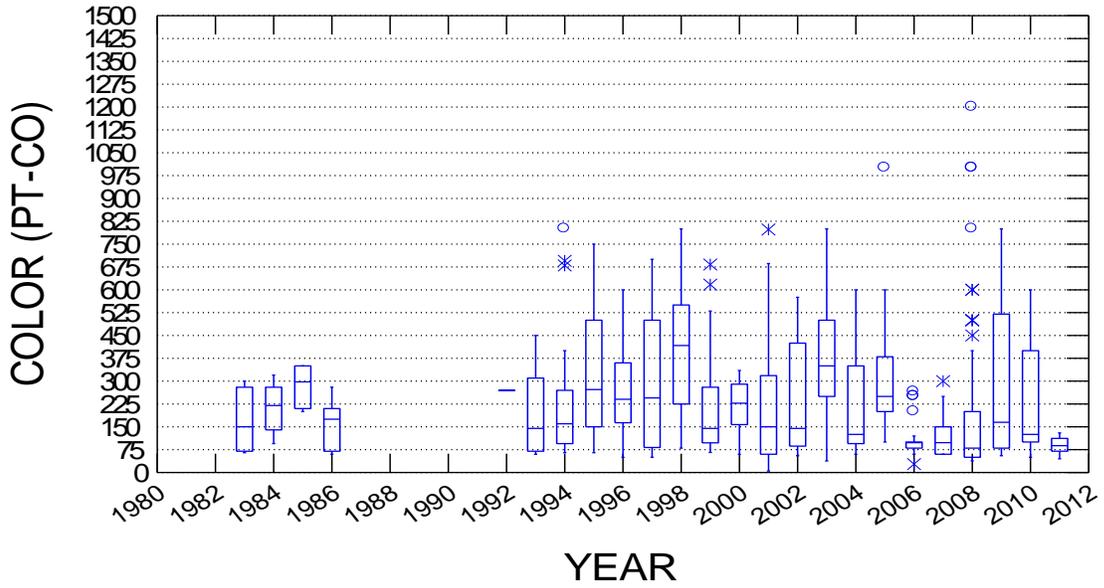
Kruskal-Wallis Test Statistic = 75.547
Probability is 0.000 assuming Chi-square distribution with 22 df

Appendix E: Chart of Corrected Chla, INORGN TN, INORGP, TP, Cond, Color, and TSS Observations by Year, Season, and Station, in Tomoka River

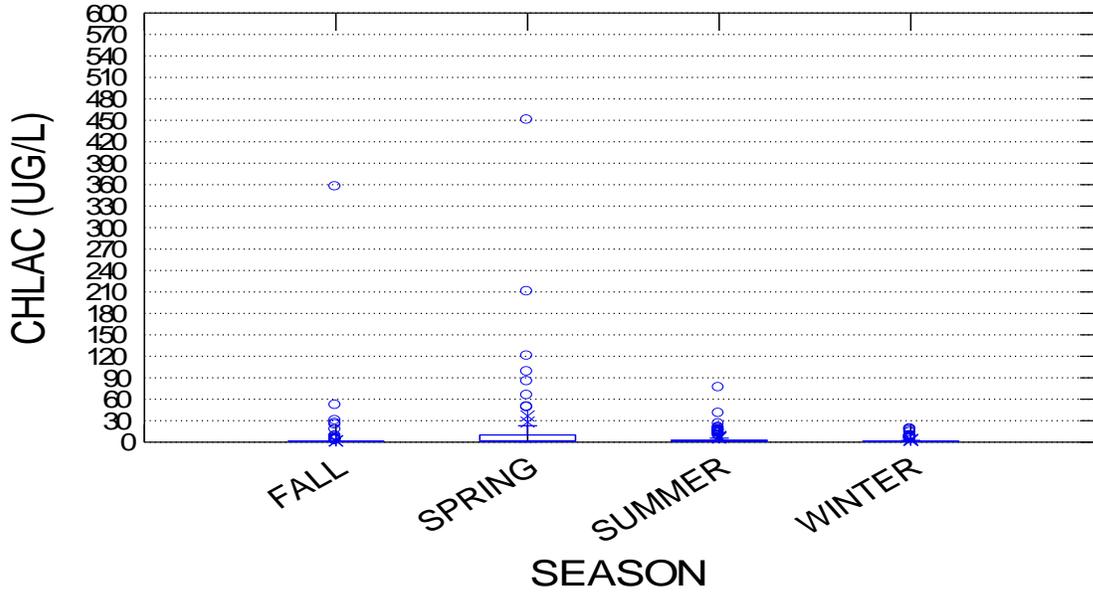




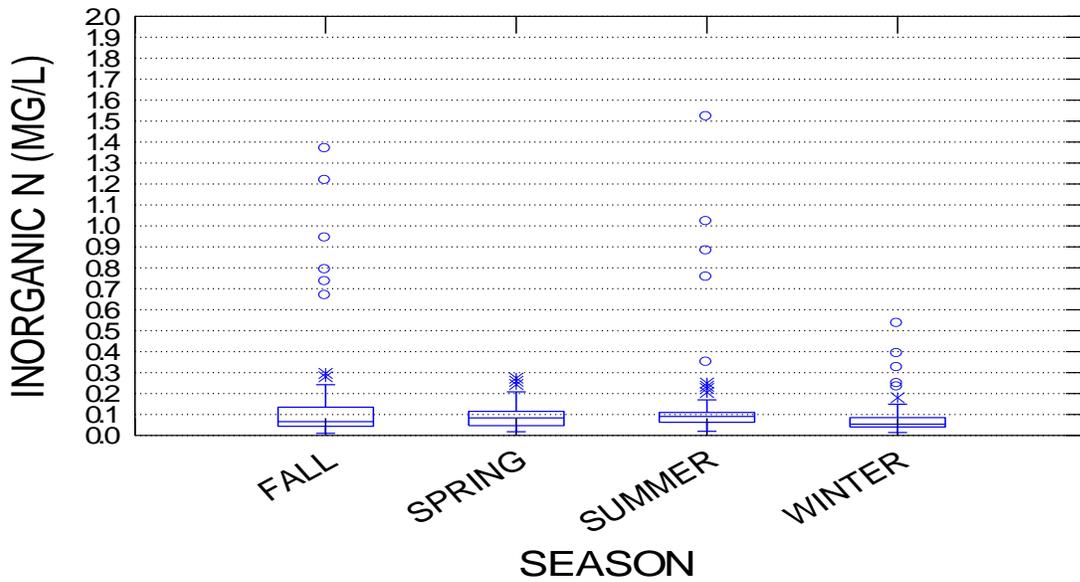




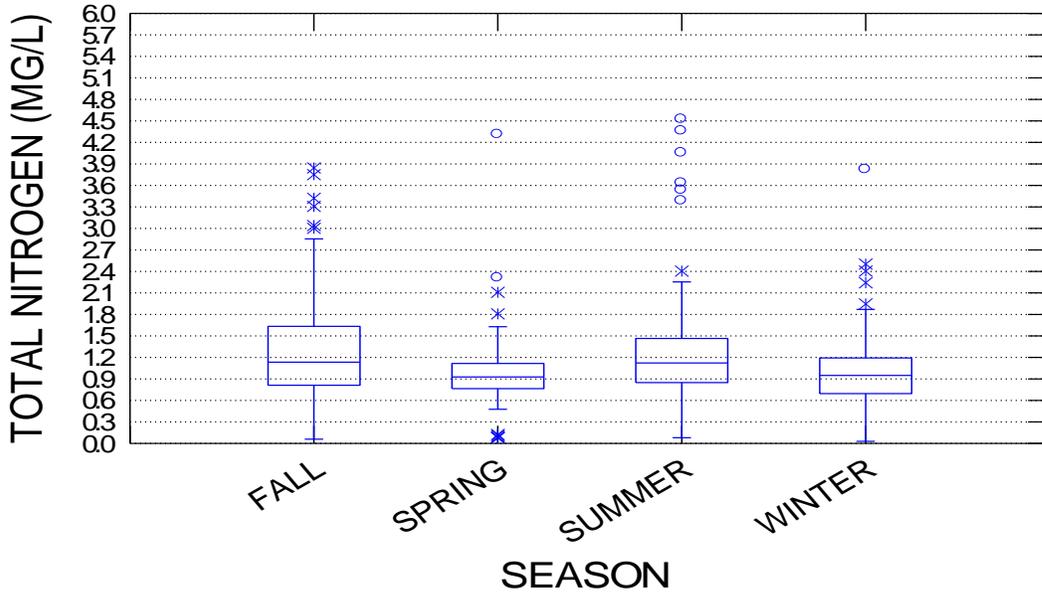
SEASONAL CHLAC



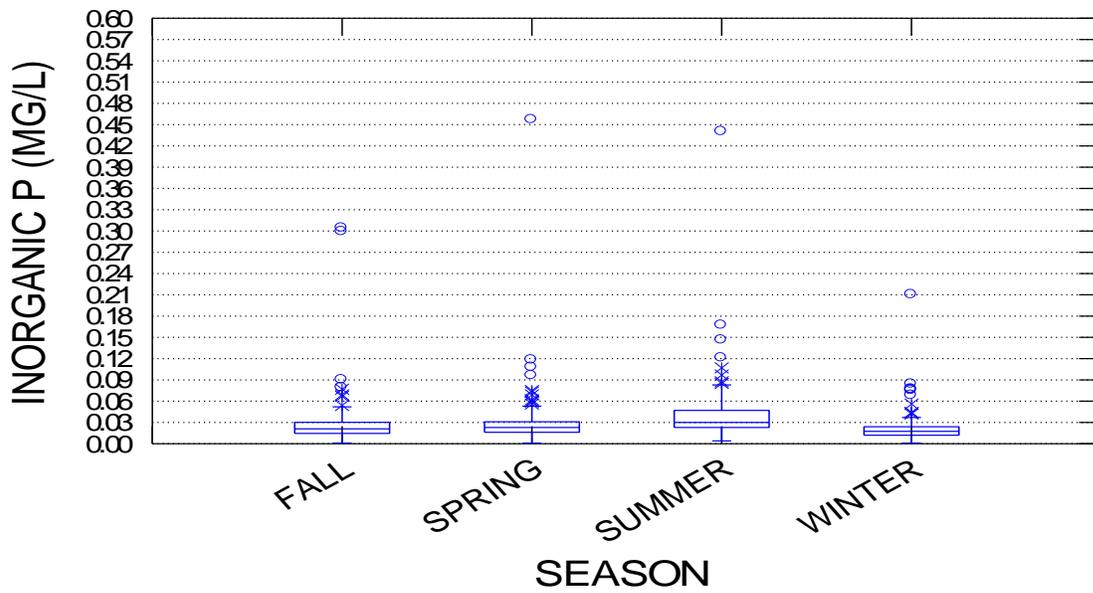
SEASONAL INORGN



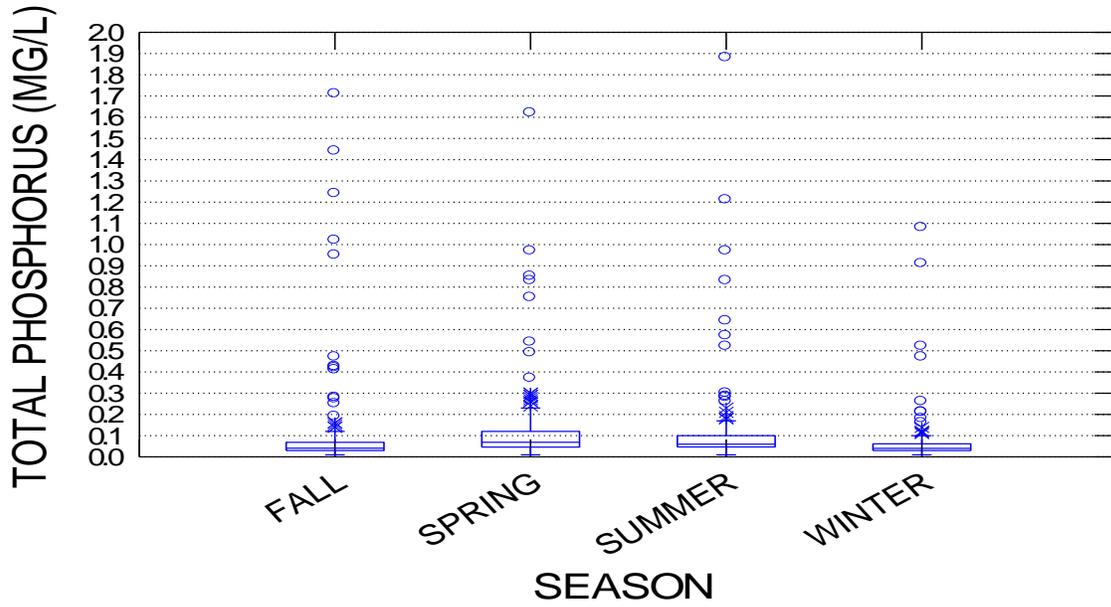
SEASONAL TN



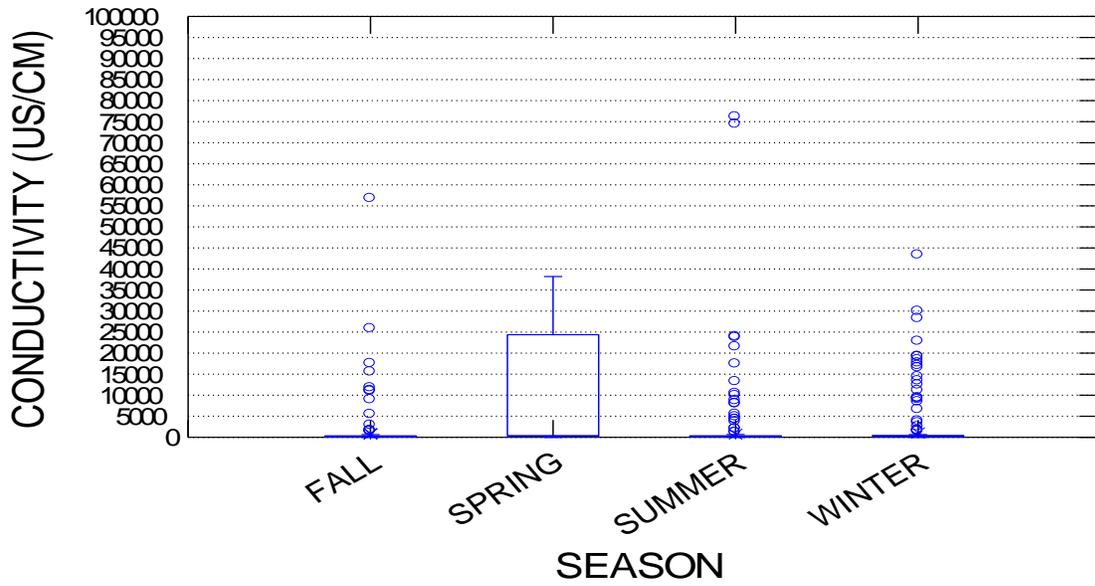
SEASONAL INORGP



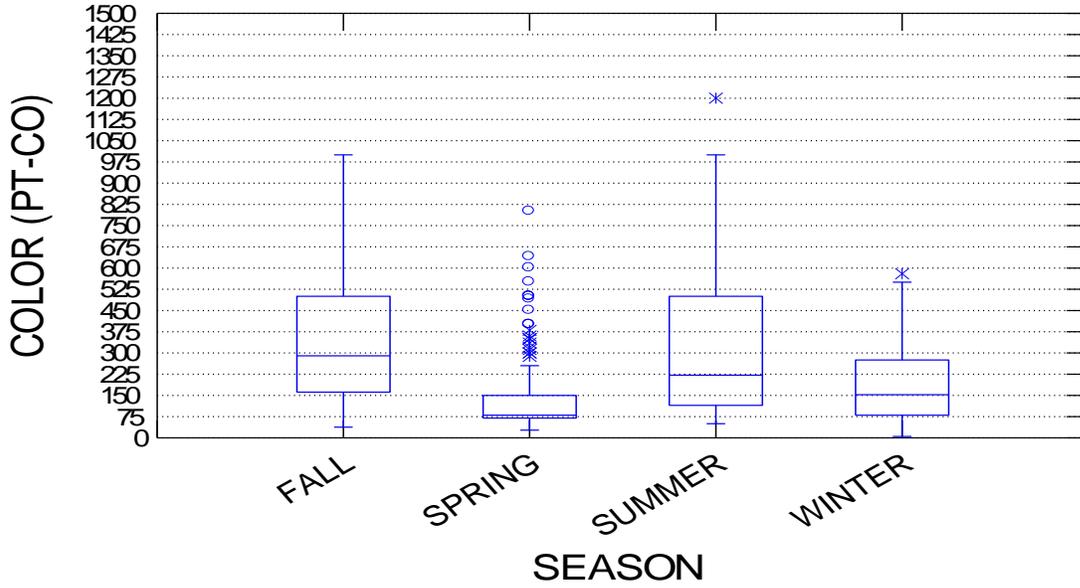
SEASONAL TP



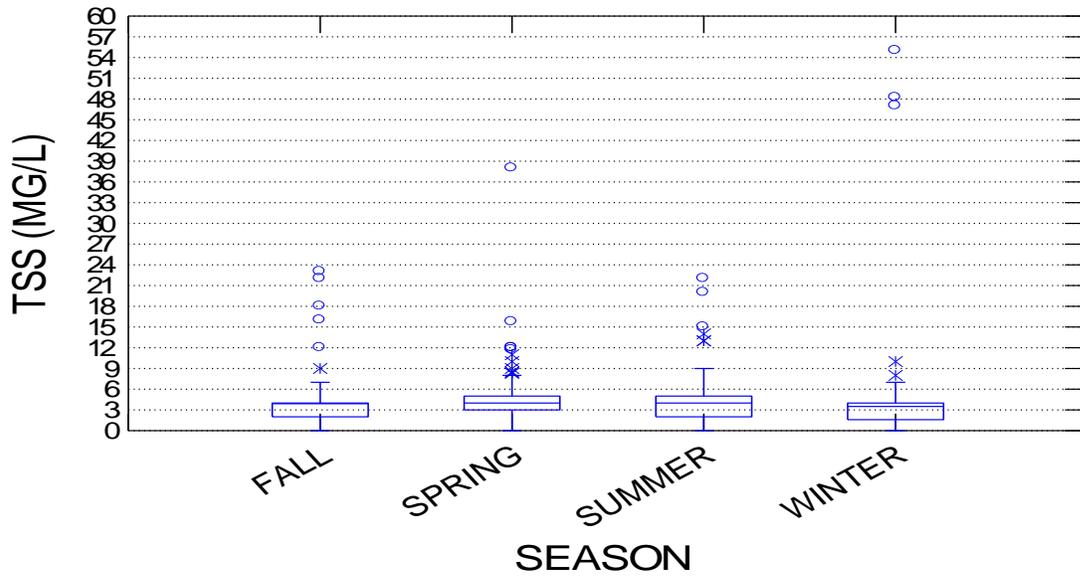
SEASONAL COND

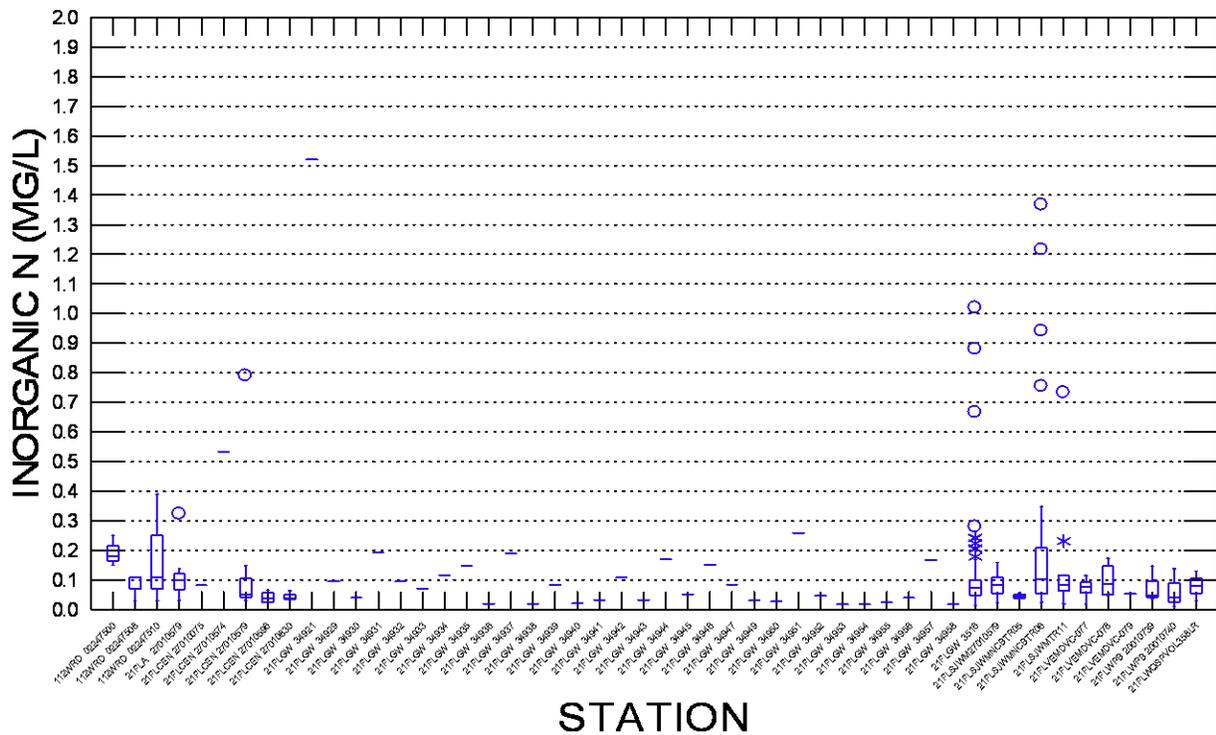
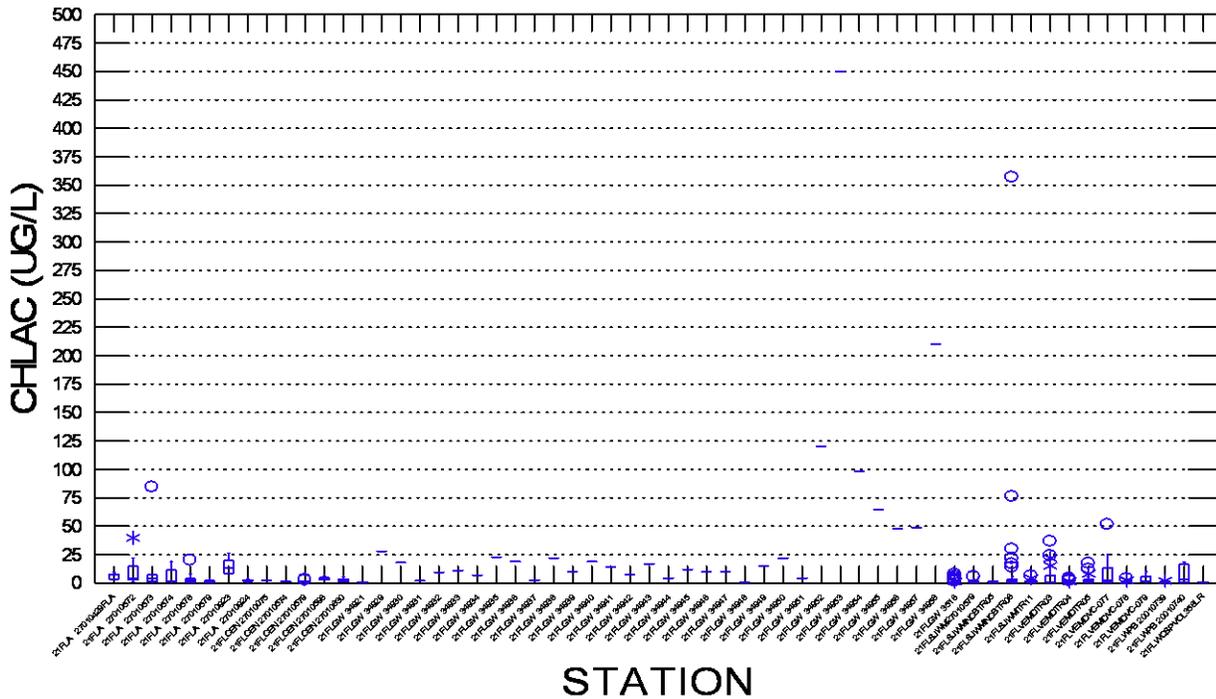


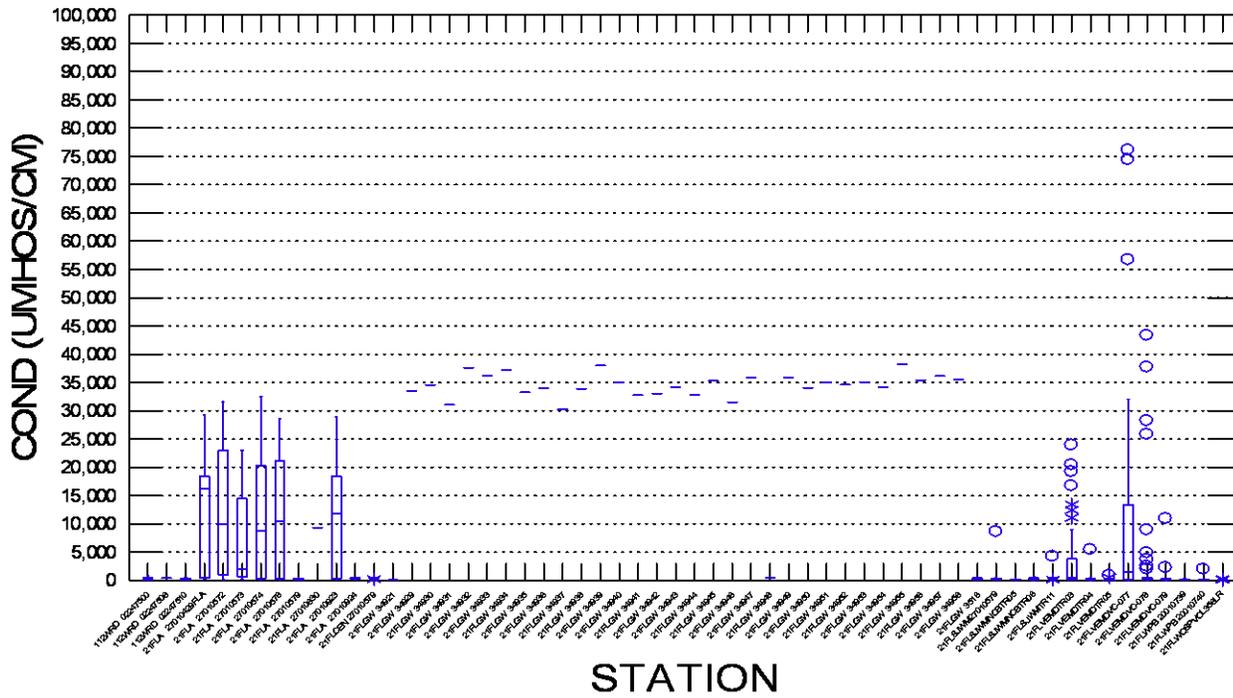
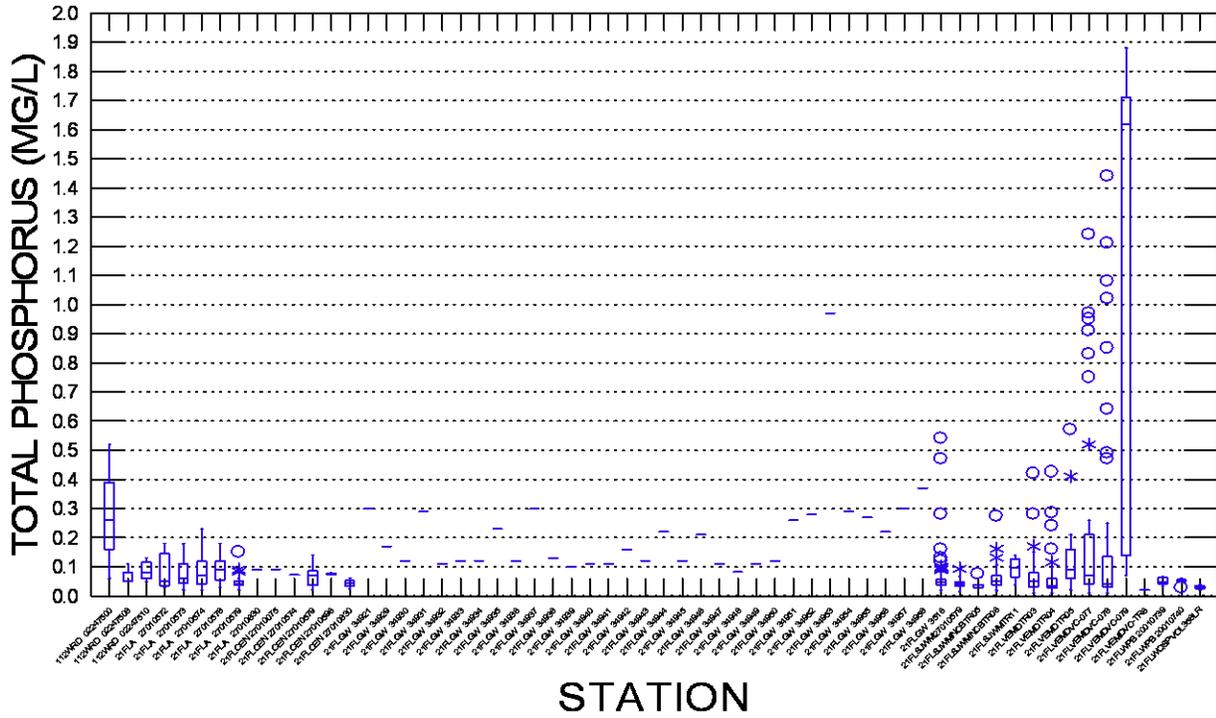
SEASONAL COLOR

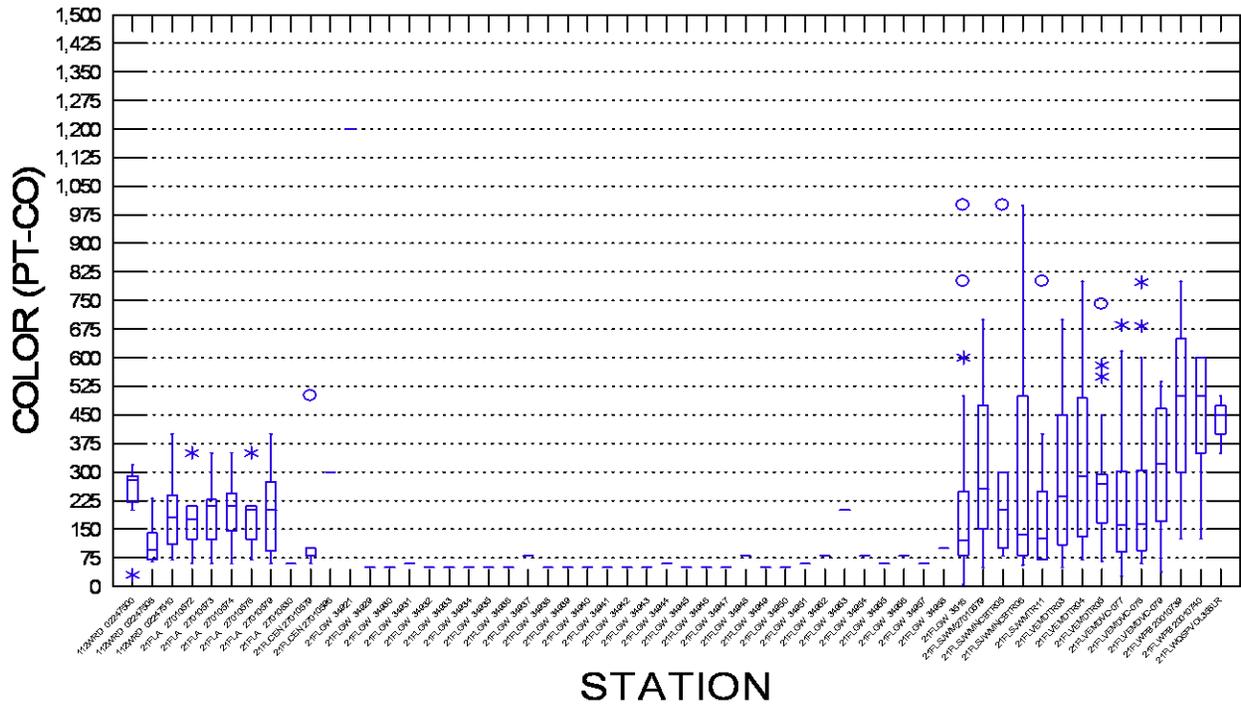


SEASONAL TSS

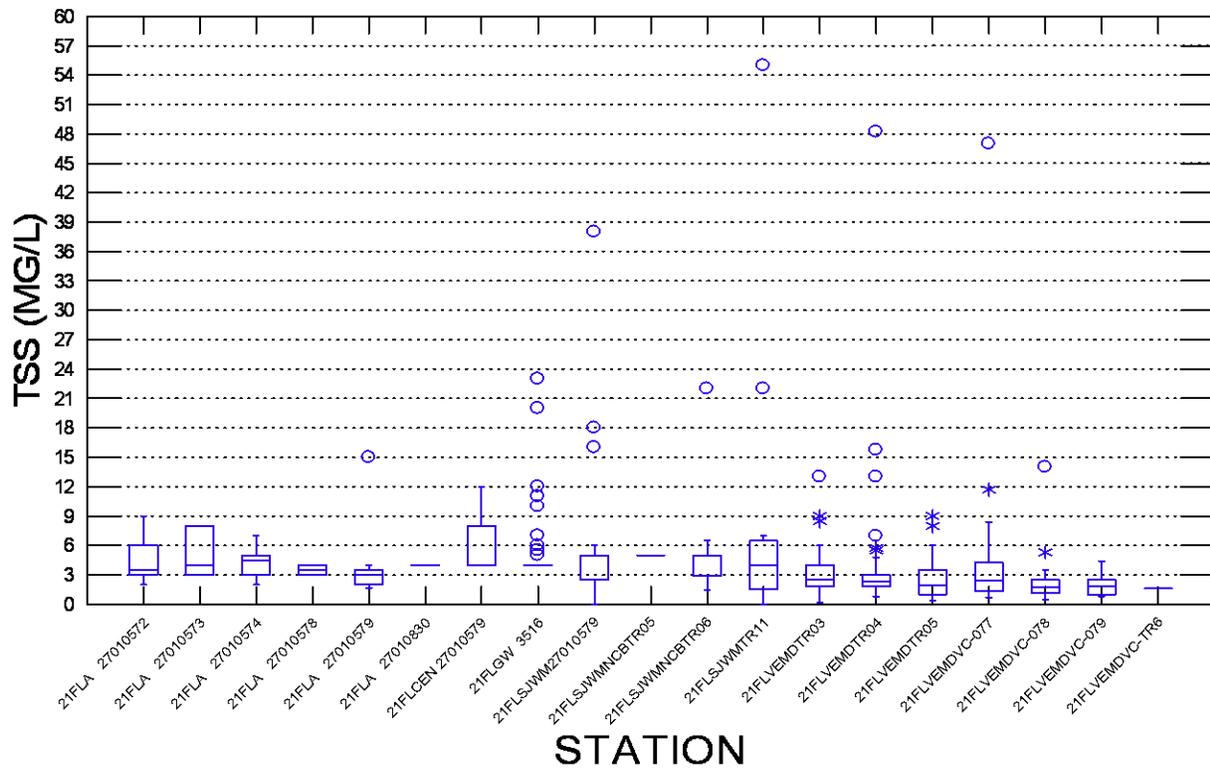






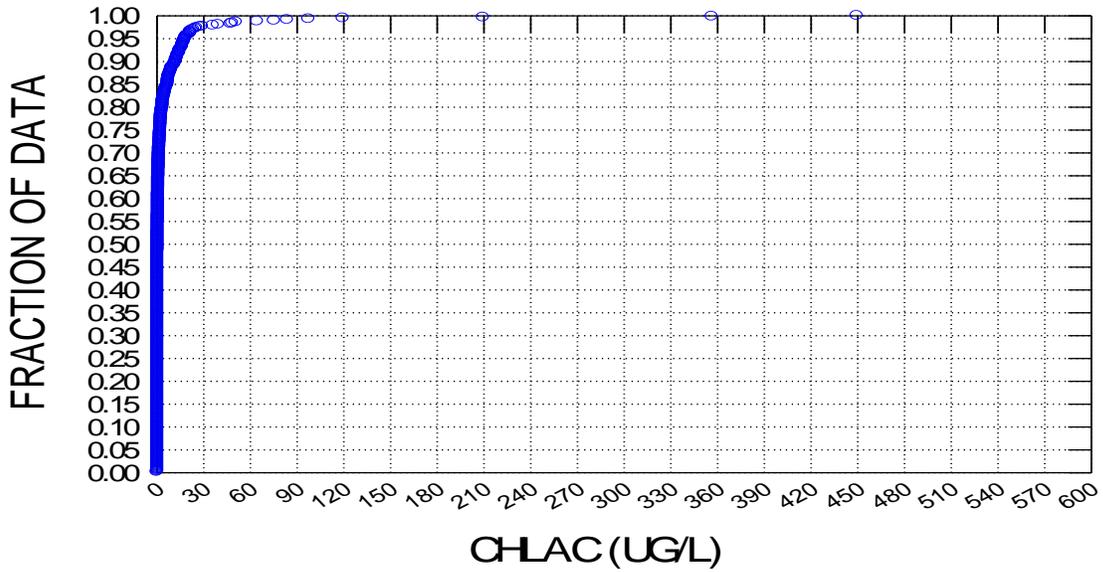


STATION

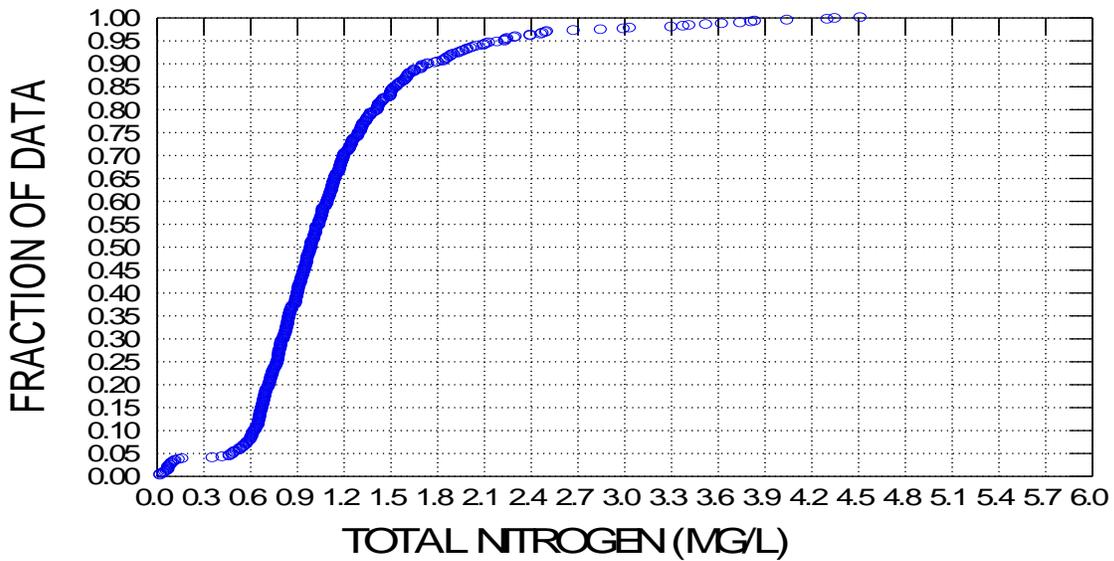


STATION

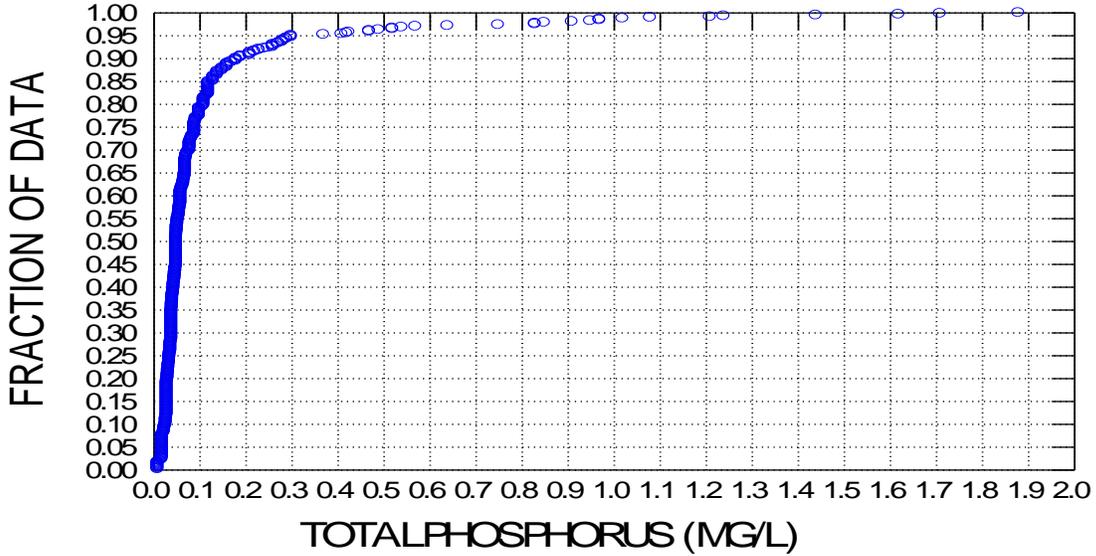
CUMULATIVE FREQUENCY PLOT CHLAC



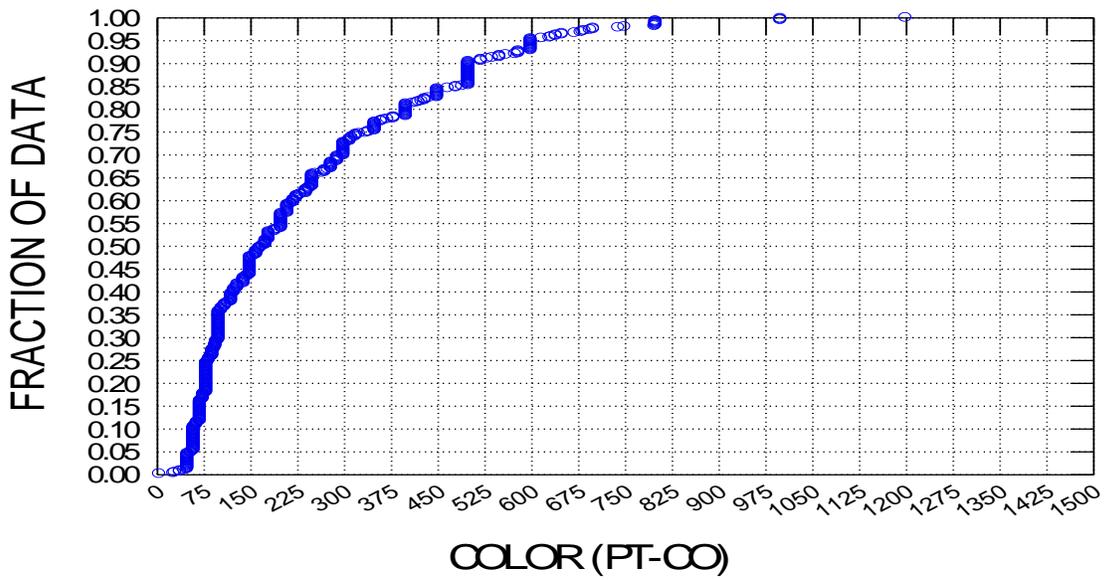
CUMULATIVE FREQUENCY PLOT TN



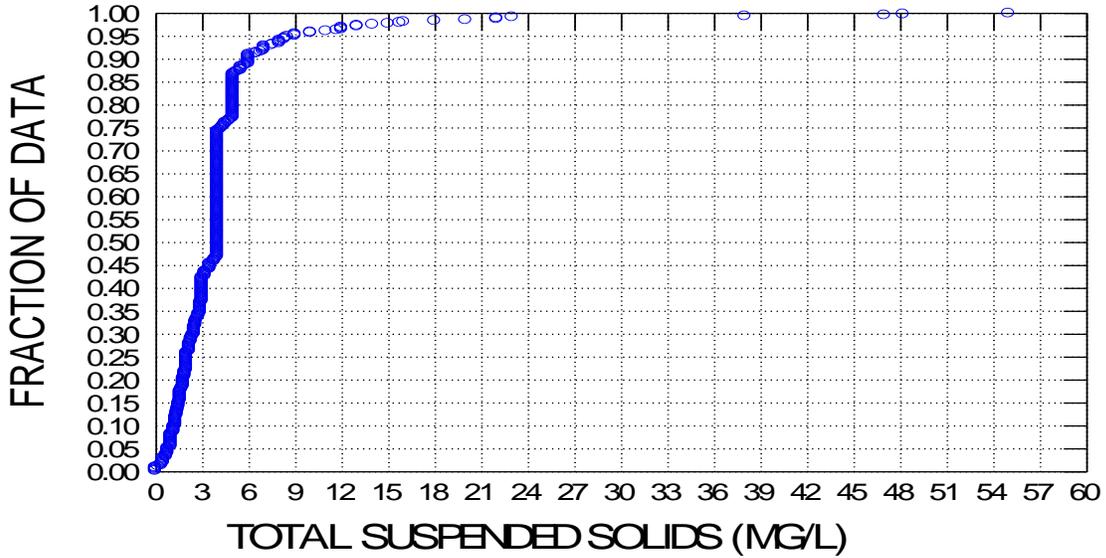
CUMULATIVE FREQUENCY PLOT TP



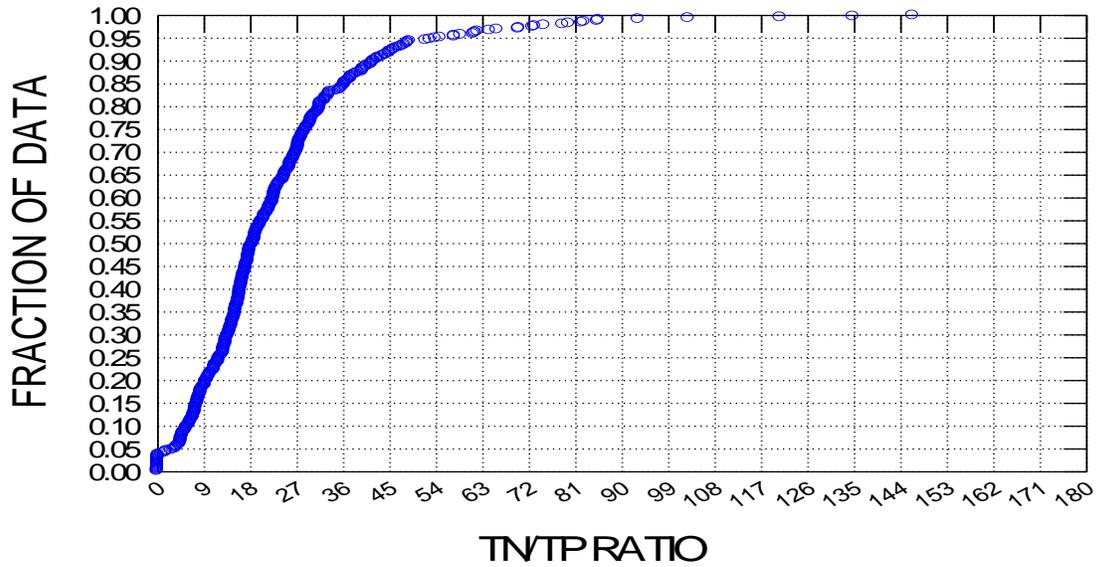
CUMULATIVE FREQUENCY PLOT COLOR



CUMULATIVE FREQUENCY PLOT TSS

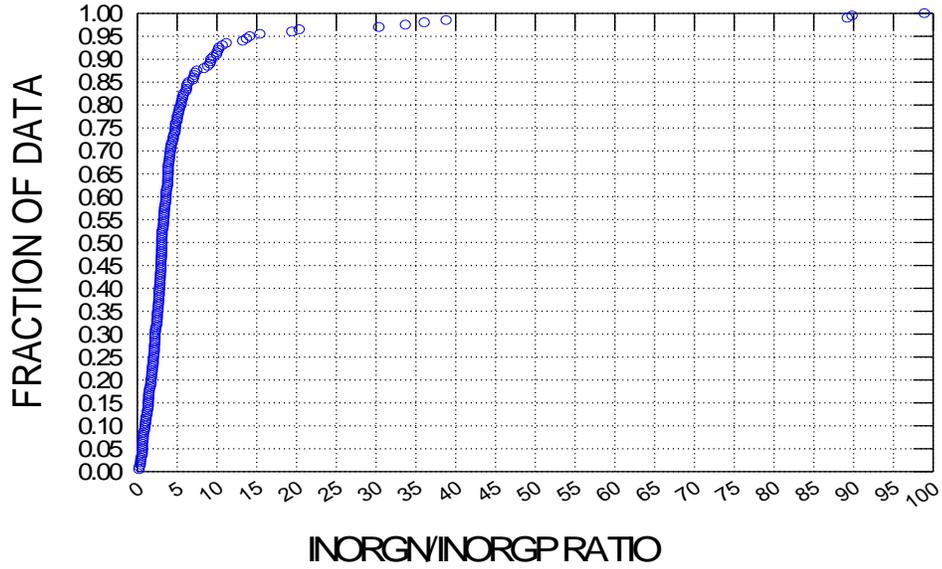


CUMULATIVE FREQUENCY PLOT TN/TP RATIO



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CUMULATIVE FREQUENCY PLOT INORGN/INORGP RATIO



Appendix F: Monthly and Annual Precipitation at Daytona International Airport, 1937–2011

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
1937	2.22	4.73	4.14	2.69	2.59	2.96	5.64	7.72	7.96	5.69	7.43	1.52	55.29
1938	0.73	3.18	1.69	1.04	1.96	2.84	8.36	2.82	8.14	3.23	3.93	1.37	39.29
1939	1.09	0.45	1.48	5.29	2.4	6.96	9.53	5.78	7.67	2.83	0.45	1.16	45.09
1940	1.65	2.24	1.98	2.45	0.97	5.21	8.53	4.44	8.59	0.04	0.16	4.3	40.56
1941	3.42	4.4	2.01	3.11	1.32	7.29	11.46	6.56	2.86	13.68	7.47	3.72	67.3
1942	2.15	2.52	5.68	0.98	2.35	10.12	2.38	3.73	6.54	2.67	1.06	2.22	42.4
1943	1.51	0.18	6.57	2.86	3.09	4.35	11.01	10.47	11.71	7.14	0.55	0.67	60.11
1944	1.28	0.29	7.21	2.87	0.45	8.27	14.58	9.33	6.46	4.4	0.55	0.12	55.81
1945	3.62	0.88	0.41	1.53	1.56	7	7.45	6.83	9.65	5.14	0.79	4.5	49.36
1946	1.62	2.98	1.76	0.49	2.8	4.23	8.17	10.21	10.75	3.87	2.81	0.61	50.3
1947	0.78	6.04	5.29	5.31	4.82	13.43	8.65	6.97	5.75	5.72	1.98	0.9	65.64
1948	4.52	1.22	5.13	2.37	0.49	2.4	10.43	7.33	9.82	8.29	1.07	1.93	55
1949	0.37	1.95	2.01	7.12	1.4	4.24	5.97	11.46	6.26	3.65	1.86	3.93	50.22
1950	0.15	0.59	3.53	2.79	2.13	6.45	5.56	3.88	5.86	13	0.74	2.54	47.22
1951	0.77	2.46	1.18	3.28	2.53	2.66	3.8	4.19	14.02	8.54	3.15	2.88	49.46
1952	0.66	6.76	3.01	1.66	4.39	1.35	1.25	9.02	11.92	5.41	1.96	0.71	48.1
1953	1.75	3.35	7.75	4.97	1.46	1.37	8.67	19.89	10	12.93	2.3	4.85	79.29
1954	0.37	0.86	2.33	6.29	3.21	2.35	3.5	3.04	1.88	4.91	3.98	1.24	33.96
1955	2.47	1.43	1.84	1.78	1.55	7.76	5.67	2.64	6.66	3.17	2.61	1.22	38.8
1956	2.55	0.9	0.25	2.42	2.48	7.41	3.01	4.06	1.94	5.82	0.46	0.06	31.36
1957	0.97	1.62	3.13	1.73	5.65	4.23	10.53	4.01	10.65	1.8	0.82	1.34	46.48
1958	3.94	4.73	5.52	2.24	2.27	6.06	1.96	4	2.19	8.52	1.77	1.95	45.15
1959	4.53	2.13	7.7	3.17	2.4	8.13	5.68	3.6	5.26	7.12	4.26	2.26	56.24
1960	1.16	9.13	7.52	0.76	0.62	10.75	8.7	6.84	10.96	0.97	0.53	1.24	59.18
1961	1.96	3.7	1.17	2.16	2.39	6.81	5.16	7.68	3.2	2.25	2.85	0.73	40.06
1962	0.9	0.82	1.82	0.78	0.16	7.96	10.04	8.5	8.84	3.57	2.49	0.71	46.59
1963	2.91	5.83	1.46	1.4	6.82	7.42	6.89	2.01	5.43	2.71	7.98	2.17	53.03
1964	5.29	2.65	4.84	3.61	2.58	4.73	7.67	10.81	11.39	3.54	3.13	2.52	62.76
1965	2.22	3	3.05	1	0.08	9	3.72	2.97	4.33	3.65	0.97	2.14	36.13
1966	2.89	5.58	0.36	2.56	6.77	15.19	7.09	7.93	4.49	4.6	1.19	1.6	60.25
1967	1.26	3.98	0.31	0	0.73	7.51	9.04	3.02	5.56	0.19	0	2.98	34.58
1968	0.42	1.73	1.79	0.4	4.79	14.38	6.25	11.09	6.07	7.44	2.43	1.38	58.17
1969	1.53	2.03	2.74	0.12	6.47	2.47	2.61	9.4	8.89	6.97	1.96	5.03	50.22
1970	3.94	3.79	3.59	2.08	1.68	2.62	3.65	3.61	3.54	3.87	0.31	0.72	33.4
1971	0.61	5.48	2	2.57	3.12	4.73	3.2	3.97	7.2	9.53	1.33	2.49	46.23
1972	2.37	3.97	6.66	1.41	4.02	7.06	3.22	8.29	0.42	3.08	10.96	2.48	53.94
1973	4.66	2.02	2.63	3.09	2.41	4.32	4.69	7.58	5.14	4.4	0.75	2.54	44.23
1974	0.3	1.1	3.19	0.44	2.66	8.65	6.31	9.96	10.5	1.42	0.48	2.2	47.21
1975	1.66	2.27	1.52	2.96	2.99	9	6.89	3.16	6.61	5.84	1.46	0.83	45.19
1976	0.6	0.7	2.03	4.27	12.33	11.14	1.07	3.8	5.1	1.9	3.38	6	52.32

Draft TMDL Report Tomoka River, WBID 2634, Nutrients

Year	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Total
1977	4.69	2.45	1.43	0.41	4.61	1.15	2.23	7.91	6.55	1.46	3.04	4.74	40.67
1978	2.89	5.98	2.31	3.3	0.56	7.48	5.53	7.99	4.63	8.31	0.07	4.89	53.94
1979	7.1	1.94	4.08	3.96	6.13	3.03	11.69	5.24	15.2	2.13	7.96	0.56	69.02
1980	3.75	0.76	2.41	2.54	3.62	5.57	5.82	4.13	1.83	2.42	3.12	1.39	37.36
1981	0.32	5.54	3	0.29	1.74	1.03	4.69	7.19	7.59	1.08	2.57	4.64	39.68
1982	2.46	2.08	5.81	6.04	4.68	8.29	5.31	3.21	4.96	3.23	1.58	2.53	50.18
1983	2.51	5.96	7.71	6.17	3.86	6.37	1.92	6.82	8.57	10.11	2.01	11.98	73.99
1984	1.46	3.44	1.31	5.29	6.04	2.84	6.77	4.02	10.73	1.09	3.52	0.2	46.71
1985	0.79	0.58	1.49	3.14	3.42	6.81	2.16	9.83	10.62	4.08	0.41	2.05	45.38
1986	7.16	1.28	1.85	0.44	0.99	3.5	14.43	3.47	3.58	3.47	5.08	2.76	48.01
1987	2.21	6.64	7.94	0.28	2.65	3.81	2.78	4.89	5.63	2.77	5.87	0.25	45.72
1988	5.36	1.72	4.57	1.68	1.78	2.39	2.94	4.79	6.81	1.24	6.7	0.93	40.91
1989	6.82	0.64	2.01	2.92	2.02	1.84	2.44	4.47	5.04	11.64	0.88	3.93	44.65
1990	1.42	5.61	1.94	1.48	1.45	2.71	5.85	7	1.61	5.88	0.83	0.34	36.12
1991	2.25	1.65	8.11	5.57	6.79	12.67	11.97	7.6	5.52	2.94	0.61	1.51	67.19
1992	2.42	1.71	2.28	2.81	3.13	10.64	0.16	8.86	6.57	5.21	2.15	0.47	46.41
1993	4.29	3.02	5.56	0.33	0.65	2.19	5.05	2.66	2.74	5.53	1.83	1.86	35.71
1994	5.6	2.66	3.44	5.05	3.09	6.54	6.91	7.08	5.93	4.72	12.91	2.71	66.64
1995	1.53	1.39	2.01	1.34	1.26	6.61	6.59	10.71	14.13	3.99	1.44	3.44	54.44
1996	5.53	1.32	12.15	2.22	2.28	11.35	1.9	5.7	3.92	11.15	0.96	2.01	60.49
1997	2.03	0.46	2.3	3.3	3.77	6.38	7.69	7.91	4.78	5.29	3.02	7.76	54.69
1998	4.33	7.25	3.97	0.14	0.16	0.83	5.63	7.56	5.79	1.84	1.66	1.35	40.51
1999	4.88	1.81	1.01	1.48	1.47	8.54	4.03	3.58	7.05	7.84	3.12	1.56	46.37
2000	1.8	0.65	8.48	1.15	0.32	3.08	5.09	3.17	13.55	0.93	1.14	0.8	40.16
2001	0.88	0.38	9.98	0.28	1.77	5.26	9.55	3.57	16.11	3.22	6.92	0.35	58.27
2002	2.01	2.76	1.51	2.53	1.66	12.3	7.35	11.56	3.86	2.94	1.85	9.61	59.94
2003	0.51	5.17	10.57	0.81	0.96	7.05	7.3	6.55	4.15	7.95	4.75	1.53	57.3
2004	1.25	4.47	1.1	1.19	0.49	5.2	10.34	17.96	16.46	1.34	0.93	2.24	62.97
2005	2.6	1.25	5.51	3.17	7.97	13.67	2.73	4.29	7.35	13.51	1.87	1.85	65.77
2006	0.24	4.33	0.08	1.11	0.78	5.72	4.48	4.81	2.97	2.53	1.1	3.21	31.36
2007	1.53	2.64	0.7	1.34	0.91	5.78	10.23	2.88	11.36	3.49	2.32	1.84	45.02
2008	1.3	2.12	3.2	1.34	0.63	3.64	9.48	10.33	4.29	4.45	0.96	0.93	42.67
2009	0.82	0.8	1.39	1.47	22.33	5.03	5.19	3.77	3.65	1.44	0.6	3.81	50.3
2010	5.92	3.92	6.2	1.04	4.74	2.86	3.88	5.83	3.49	0.18	0.95	0.38	39.39
2011	4.37	1.2	5.55	0.46	0.65	12.29	3.15	5.75	6.23	5.88	0.1	3.08	48.71
AVG	2.44	2.79	3.62	2.32	2.99	6.20	6.15	6.48	6.98	4.78	2.52	2.36	49.63

Rainfall is in inches, and represents data from DIA.

Appendix G: Spearman Correlation Matrix Analysis for Water Quality Parameters in Tomoka River

Spearman correlation matrix

	CHLAC	CHLORIDE	COLOR	COND	NH4
CHLAC	1.000				
CHLORIDE	-0.012	1.000			
COLOR	-0.326	-0.707	1.000		
COND	0.435	0.895	-0.704	1.000	
NH4	0.071	-0.194	0.212	-0.183	1.000
NO3O2	-0.164	0.142	0.081	0.032	0.324
SALINITY	0.443	0.920	-0.688	0.836	-0.203
SO4	0.007	0.483	-0.601	0.573	-0.188
TEMPC	0.412	-0.164	-0.057	0.157	0.174
TKN	0.107	-0.603	0.580	-0.324	0.387
TN	0.087	-0.582	0.579	-0.354	0.401
TOC	-0.022	-0.654	0.887	-0.756	0.373
TP	0.398	-0.046	-0.120	0.244	0.284
TSS	0.128	0.038	-0.185	0.127	-0.057
TURB	0.106	0.038	0.118	-0.060	0.018
INORGP	0.092	-0.224	0.088	-0.014	0.054
INORGN	-0.068	-0.011	0.226	-0.115	0.745
PRECP	0.079	-0.053	0.036	0.044	-0.004
V3DAY	0.063	-0.254	0.086	-0.076	-0.066
V7DAY	0.110	-0.338	0.125	-0.163	-0.004
V14DAY	-0.023	-0.521	0.297	-0.340	0.013
V21DAY	-0.092	-0.611	0.436	-0.416	0.023

	NO3O2	SALINITY	SO4	TEMPC	TKN
NO3O2	1.000				
SALINITY	-0.023	1.000			
SO4	0.067	0.604	1.000		
TEMPC	0.126	0.176	-0.143	1.000	
TKN	0.016	-0.299	-0.568	0.180	1.000
TN	0.094	-0.288	-0.564	0.188	0.993
TOC	-0.044	-0.736	-0.570	0.108	0.837
TP	-0.026	0.305	-0.037	0.447	0.164
TSS	0.037	0.024	-0.053	0.122	-0.006
TURB	0.150	-0.062	0.016	0.031	0.140
INORGP	0.078	-0.026	-0.199	0.401	0.247
INORGN	0.796	-0.149	-0.075	0.169	0.254
PRECP	0.049	-0.024	0.112	0.148	0.067
V3DAY	-0.022	-0.111	0.085	0.125	0.068
V7DAY	-0.081	-0.145	0.106	0.227	0.068
V14DAY	-0.108	-0.302	-0.063	0.220	0.169
V21DAY	-0.096	-0.378	-0.127	0.201	0.257

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Spearman correlation matrix (cont.)

	TN	TOC	TP	TSS	TURB
TN	1.000				
TOC	0.826	1.000			
TP	0.169	0.046	1.000		
TSS	-0.019	-0.018	0.165	1.000	
TURB	0.169	-0.124	0.125	0.332	1.000
INORGP	0.299	0.197	0.444	-0.080	-0.047
INORGN	0.333	0.188	0.245	0.056	0.105
PRECP	0.078	0.021	0.089	0.013	0.059
V3DAY	0.052	0.012	0.044	-0.050	0.096
V7DAY	0.051	0.009	0.163	-0.088	0.100
V14DAY	0.152	0.207	0.060	-0.193	0.054
V21DAY	0.249	0.340	0.048	-0.255	0.025

	INORGP	INORGN	PRECP	V3DAY	V7DAY
INORGP	1.000				
INORGN	0.195	1.000			
PRECP	0.126	0.059	1.000		
V3DAY	0.100	-0.015	0.559	1.000	
V7DAY	0.149	-0.088	0.299	0.604	1.000
V14DAY	0.222	-0.053	0.196	0.461	0.741
V21DAY	0.300	-0.055	0.176	0.410	0.644

	V14DAY	V21DAY
V14DAY	1.000	
V21DAY	0.857	1.000

Pairwise frequency table

	CHLAC	CHLORIDE	COLOR	COND	NH4
CHLAC	567				
CHLORIDE	180	224			
COLOR	524	222	604		
COND	540	211	581	628	
NH4	284	197	298	286	312
NO3O2	532	199	559	548	308
SALINITY	471	141	474	507	227
SO4	178	221	221	208	197
TEMPC	563	198	575	613	304
TKN	526	199	548	531	305
TN	497	199	511	497	303
TOC	178	177	182	180	180
TP	523	197	544	530	302
TSS	466	183	486	479	232
TURB	517	188	536	532	279
INORGP	356	158	397	390	203
INORGN	277	197	290	278	304
PRECP	567	224	604	628	312
V3DAY	567	224	604	628	312
V7DAY	567	224	604	628	312
V14DAY	567	224	604	628	312
V21DAY	567	224	604	628	312

	NO3O2	SALINITY	SO4	TEMPC	TKN
NO3O2	581				
SALINITY	466	517			
SO4	199	140	222		
TEMPC	570	517	196	672	
TKN	552	449	199	554	566
TN	526	413	199	516	526
TOC	182	138	176	181	182
TP	545	447	197	553	558
TSS	477	415	182	487	484
TURB	530	453	188	544	538
INORGP	392	334	156	396	373
INORGN	304	224	197	296	298
PRECP	581	517	222	672	566
V3DAY	581	517	222	672	566
V7DAY	581	517	222	672	566
V14DAY	581	517	222	672	566
V21DAY	581	517	222	672	566

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Pairwise frequency table (cont.)

	TN	TOC	TP	TSS	TURB
TN	527				
TOC	182	182			
TP	521	178	563		
TSS	447	179	480	492	
TURB	499	177	531	487	550
INORGP	342	139	368	366	365
INORGN	298	180	294	229	272
PRECP	527	182	563	492	550
V3DAY	527	182	563	492	550
V7DAY	527	182	563	492	550
V14DAY	527	182	563	492	550
V21DAY	527	182	563	492	550

	INORGP	INORGN	PRECP	V3DAY	V7DAY
INORGP	406				
INORGN	200	304			
PRECP	406	304	705		
V3DAY	406	304	705	705	
V7DAY	406	304	705	705	705
V14DAY	406	304	705	705	705
V21DAY	406	304	705	705	705

	V14DAY	V21DAY
V14DAY	705	
V21DAY	705	705

Appendix H: Linear Regression Analysis of CHLAC Observations versus COND, SALINITY, TEMPC, Nutrients, TSS, TURBIDITY, and V21DAY in Tomoka River

Dep Var: CHLAC N: 540 Multiple R: 0.293 Squared multiple R: 0.086

Adjusted squared multiple R: 0.084 Standard error of estimate: 26.790

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	2.939	1.247	0.000	.	2.357	0.019
COND	0.001	0.000	0.293	1.000	7.107	0.000

Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	36245.495	1	36245.495	50.504	0.000
Residual	386112.688	538	717.682		

*** WARNING ***

- Case 305 has large leverage (Leverage = 0.083)
- Case 430 has large leverage (Leverage = 0.047)
- Case 571 is an outlier (Studentized Residual = 7.060)
- Case 572 is an outlier (Studentized Residual = 21.593)
- Case 639 is an outlier (Studentized Residual = 16.075)
- Case 668 has large leverage (Leverage = 0.087)

Durbin-Watson D Statistic 1.468
 First Order Autocorrelation 0.266

Dep Var: CHLAC N: 471 Multiple R: 0.326 Squared multiple R: 0.106

Adjusted squared multiple R: 0.104 Standard error of estimate: 28.309

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	2.838	1.419	0.000	.	1.999	0.046
SALINITY	1.586	0.212	0.326	1.000	7.470	0.000

Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	44719.072	1	44719.072	55.802	0.000
Residual	375850.786	469	801.388		

*** WARNING ***

- Case 571 is an outlier (Studentized Residual = 6.395)
- Case 572 is an outlier (Studentized Residual = 20.089)
- Case 639 is an outlier (Studentized Residual = 15.323)

Durbin-Watson D Statistic 1.485
 First Order Autocorrelation 0.257

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Dep Var: CHLAC N: 563 Multiple R: 0.203 Squared multiple R: 0.041

Adjusted squared multiple R: 0.040 Standard error of estimate: 26.890

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	-16.334	4.725	0.000	.	-3.457	0.001
TEMPC	1.050	0.214	0.203	1.000	4.915	0.000

Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	17463.603	1	17463.603	24.153	0.000
Residual	405633.806	561	723.055		

*** WARNING ***

Case 571 is an outlier (Studentized Residual = 7.621)
 Case 572 is an outlier (Studentized Residual = 22.237)
 Case 639 is an outlier (Studentized Residual = 15.499)

Durbin-Watson D Statistic 1.387
 First Order Autocorrelation 0.307

Dep Var: CHLAC N: 497 Multiple R: 0.290 Squared multiple R: 0.084

Adjusted squared multiple R: 0.082 Standard error of estimate: 27.842

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	-8.620	2.556	0.000	.	-3.372	0.001
TN	13.311	1.978	0.290	1.000	6.729	0.000

Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	35102.535	1	35102.535	45.282	0.000
Residual	383721.267	495	775.194		

*** WARNING ***

Case 571 is an outlier (Studentized Residual = 7.370)
 Case 572 has large leverage (Leverage = 0.053)
 Case 572 is an outlier (Studentized Residual = 19.828)
 Case 583 has large leverage (Leverage = 0.060)
 Case 584 has large leverage (Leverage = 0.045)
 Case 585 has large leverage (Leverage = 0.037)
 Case 587 has large leverage (Leverage = 0.039)
 Case 639 is an outlier (Studentized Residual = 13.675)
 Case 684 has large leverage (Leverage = 0.039)
 Case 700 has large leverage (Leverage = 0.055)

Durbin-Watson D Statistic 1.267
 First Order Autocorrelation 0.366

Dep Var: CHLAC N: 523 Multiple R: 0.190 Squared multiple R: 0.036

Adjusted squared multiple R: 0.034 Standard error of estimate: 27.927

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	3.460	1.379	0.000	.	2.509	0.012
TP	25.832	5.847	0.190	1.000	4.418	0.000

Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	15221.859	1	15221.859	19.517	0.000
Residual	406345.753	521	779.934		

*** WARNING ***

- Case 325 has large leverage (Leverage = 0.043)
- Case 330 has large leverage (Leverage = 0.102)
- Case 334 has large leverage (Leverage = 0.038)
- Case 335 has large leverage (Leverage = 0.114)
- Case 347 has large leverage (Leverage = 0.034)
- Case 348 has large leverage (Leverage = 0.055)
- Case 349 has large leverage (Leverage = 0.139)
- Case 353 has large leverage (Leverage = 0.058)
- Case 354 has large leverage (Leverage = 0.080)
- Case 571 is an outlier (Studentized Residual = 7.429)
- Case 572 has large leverage (Leverage = 0.034)
- Case 572 is an outlier (Studentized Residual = 20.741)
- Case 639 is an outlier (Studentized Residual = 14.790)

Durbin-Watson D Statistic 1.328
 First Order Autocorrelation 0.336

Dep Var: CHLAC N: 466 Multiple R: 0.204 Squared multiple R: 0.042

Adjusted squared multiple R: 0.039 Standard error of estimate: 17.577

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	0.684	1.105	0.000	.	0.619	0.536
TSS	0.804	0.179	0.204	1.000	4.484	0.000

Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	6210.561	1	6210.561	20.102	0.000
Residual	143352.240	464	308.949		

*** WARNING ***

- Case 88 is an outlier (Studentized Residual = 4.489)
- Case 160 has large leverage (Leverage = 0.271)
- Case 163 has large leverage (Leverage = 0.204)
- Case 170 has large leverage (Leverage = 0.121)
- Case 376 has large leverage (Leverage = 0.193)
- Case 639 is an outlier (Studentized Residual = 47.274)
- Case 666 is an outlier (Studentized Residual = 4.057)
- Case 677 has large leverage (Leverage = 0.039)

Durbin-Watson D Statistic 1.973
 First Order Autocorrelation 0.013

Draft TMDL Report Tomoka River, WBID 2634, Nutrients

Dep Var: CHLAC N: 517 Multiple R: 0.161 Squared multiple R: 0.026

Adjusted squared multiple R: 0.024 Standard error of estimate: 28.235

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	3.016	1.539	0.000	.	1.960	0.051
TURB	0.988	0.268	0.161	1.000	3.691	0.000

Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	10859.575	1	10859.575	13.622	0.000
Residual	410551.414	515	797.187		

*** WARNING ***

Case 160 has large leverage (Leverage = 0.450)
 Case 163 has large leverage (Leverage = 0.321)
 Case 376 has large leverage (Leverage = 0.585)
 Case 571 is an outlier (Studentized Residual = 7.397)
 Case 572 is an outlier (Studentized Residual = 20.938)
 Case 574 is an outlier (Studentized Residual = 4.053)
 Case 639 is an outlier (Studentized Residual = 14.374)

Durbin-Watson D Statistic 1.352
 First Order Autocorrelation 0.324

Dep Var: CHLAC N: 567 Multiple R: 0.090 Squared multiple R: 0.008

Adjusted squared multiple R: 0.006 Standard error of estimate: 27.256

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	8.816	1.671	0.000	.	5.275	0.000
V21DAY	-0.881	0.409	-0.090	1.000	-2.157	0.031

Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	3456.574	1	3456.574	4.653	0.031
Residual	419722.739	565	742.872		

*** WARNING ***

Case 571 is an outlier (Studentized Residual = 7.815)
 Case 572 is an outlier (Studentized Residual = 22.237)
 Case 574 is an outlier (Studentized Residual = 4.184)
 Case 617 has large leverage (Leverage = 0.079)
 Case 639 is an outlier (Studentized Residual = 15.203)

Durbin-Watson D Statistic 1.360
 First Order Autocorrelation 0.320

Appendix I: Linear Regression Analysis of Annual Average CHLAC Observations versus COND, SALINITY, TEMPC, and Nutrients in Tomoka River

Dep Var: CHLAC N: 18 Multiple R: 0.572 Squared multiple R: 0.327

Adjusted squared multiple R: 0.285 Standard error of estimate: 2.496

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	1.304	1.044	0.000	.	1.249	0.230
COND	0.001	0.000	0.572	1.000	2.790	0.013

Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	48.489	1	48.489	7.783	0.013
Residual	99.680	16	6.230		

*** WARNING ***

Case 16 is an outlier (Studentized Residual = 2.822)

Durbin-Watson D Statistic 1.166

First Order Autocorrelation 0.360

Dep Var: CHLAC N: 16 Multiple R: 0.645 Squared multiple R: 0.416

Adjusted squared multiple R: 0.374 Standard error of estimate: 2.438

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	0.974	1.042	0.000	.	0.935	0.366
INORGN	22.493	7.121	0.645	1.000	3.159	0.007

Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	59.279	1	59.279	9.976	0.007
Residual	83.188	14	5.942		

*** WARNING ***

Case 15 has large leverage (Leverage = 0.746)

Case 16 is an outlier (Studentized Residual = 5.776)

Durbin-Watson D Statistic 1.131

First Order Autocorrelation 0.362

Draft TMDL Report Tomoka River, WBID 2634, Nutrients

Dep Var: CHLAC N: 16 Multiple R: 0.651 Squared multiple R: 0.424

Adjusted squared multiple R: 0.382 Standard error of estimate: 2.422

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	1.851	0.824	0.000	.	2.248	0.041
NH4	30.160	9.402	0.651	1.000	3.208	0.006

Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	60.353	1	60.353	10.290	0.006
Residual	82.114	14	5.865		

*** WARNING ***

Case 15 has large leverage (Leverage = 0.751)

Case 16 is an outlier (Studentized Residual = 5.260)

Durbin-Watson D Statistic 1.096

First Order Autocorrelation 0.358

Dep Var: CHLAC N: 18 Multiple R: 0.593 Squared multiple R: 0.352

Adjusted squared multiple R: 0.311 Standard error of estimate: 2.450

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	-0.240	1.459	0.000	.	-0.164	0.872
NO3O2	73.723	25.017	0.593	1.000	2.947	0.009

Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	52.129	1	52.129	8.684	0.009
Residual	96.041	16	6.003		

*** WARNING ***

Case 15 has large leverage (Leverage = 0.688)

Case 16 is an outlier (Studentized Residual = 4.308)

Durbin-Watson D Statistic 1.222

First Order Autocorrelation 0.327

Dep Var: CHLAC N: 16 Multiple R: 0.765 Squared multiple R: 0.585

Adjusted squared multiple R: 0.555 Standard error of estimate: 2.087

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	1.296	0.759	0.000	.	1.709	0.110
SALINITY	1.908	0.430	0.765	1.000	4.439	0.001

Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	85.786	1	85.786	19.700	0.001
Residual	60.963	14	4.355		

*** WARNING ***

Case 15 has large leverage (Leverage = 0.577)

Durbin-Watson D Statistic 0.832
 First Order Autocorrelation 0.528

Dep Var: CHLAC N: 18 Multiple R: 0.492 Squared multiple R: 0.242

Adjusted squared multiple R: 0.195 Standard error of estimate: 2.649

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	-30.928	15.334	0.000	.	-2.017	0.061
TEMPC	1.640	0.725	0.492	1.000	2.261	0.038

Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	35.872	1	35.872	5.111	0.038
Residual	112.297	16	7.019		

*** WARNING ***

Case 16 is an outlier (Studentized Residual = 2.980)

Durbin-Watson D Statistic 0.873
 First Order Autocorrelation 0.555

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Dep Var: CHLAC N: 18 Multiple R: 0.637 Squared multiple R: 0.406

Adjusted squared multiple R: 0.369 Standard error of estimate: 2.345

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	-1.734	1.735	0.000	.	-0.999	0.333
TN	5.105	1.543	0.637	1.000	3.309	0.004

Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	60.196	1	60.196	10.948	0.004
Residual	87.973	16	5.498		

*** WARNING ***

Case 16 is an outlier (Studentized Residual = 3.525)

Durbin-Watson D Statistic 0.807
 First Order Autocorrelation 0.575

Dep Var: CHLAC N: 13 Multiple R: 0.0634312 Squared multiple R: 0.0040235

Adjusted squared multiple R: 0.0000000 Standard error of estimate: 3.4735644

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	3.7728594	1.8744781	0.0000000	.	2.01275	0.06927
TNLOAD	-0.0000010	0.0000047	-0.0634312	1.00E+00	-0.21080	0.83690

Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	0.5361675	1	0.5361675	0.0444375	0.8368960
Residual	132.7221477	11	12.0656498		

*** WARNING ***

Case 12 has large leverage (Leverage = 0.5615714)
 Case 16 is an outlier (Studentized Residual = 3.2387521)

Durbin-Watson D Statistic 0.6720300
 First Order Autocorrelation 0.4222076

Dep Var: CHLAC N: 13 Multiple R: 0.0705083 Squared multiple R: 0.0049714

Adjusted squared multiple R: 0.0000000 Standard error of estimate: 3.4719111

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	3.9097116	2.2464784	0.0000000	.	1.74037	0.10966
TPLOAD	-0.0000215	0.0000918	-0.0705083	1.00E+00	-0.23443	0.81896

Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	0.6624836	1	0.6624836	0.0549589	0.8189551
Residual	132.5958316	11	12.0541665		

*** WARNING ***

Case 12 has large leverage (Leverage = 0.5939866)
 Case 16 is an outlier (Studentized Residual = 3.2372430)

Durbin-Watson D Statistic 0.6782025
 First Order Autocorrelation 0.4196106

Dep Var: CHLAC N: 18 Multiple R: 0.608 Squared multiple R: 0.370

Adjusted squared multiple R: 0.330 Standard error of estimate: 2.416

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	4.095	0.583	0.000	.	7.023	0.000
VDEFICIT3EA	-0.091	0.030	-0.608	1.000	-3.064	0.007

Analysis of Variance

Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	54.787	1	54.787	9.387	0.007
Residual	93.383	16	5.836		

*** WARNING ***

Case 16 is an outlier (Studentized Residual = 3.610)

Durbin-Watson D Statistic 1.212
 First Order Autocorrelation 0.391

Dep Var: CHLAC N: 18 Multiple R: 0.547 Squared multiple R: 0.300

Adjusted squared multiple R: 0.256 Standard error of estimate: 2.547

Effect	Coefficient	Std Error	Std Coef	Tolerance	t	P(2 Tail)
CONSTANT	4.329	0.645	0.000	.	6.709	0.000
VDEFICIT5EA	-0.072	0.028	-0.547	1.000	-2.617	0.019

Analysis of Variance

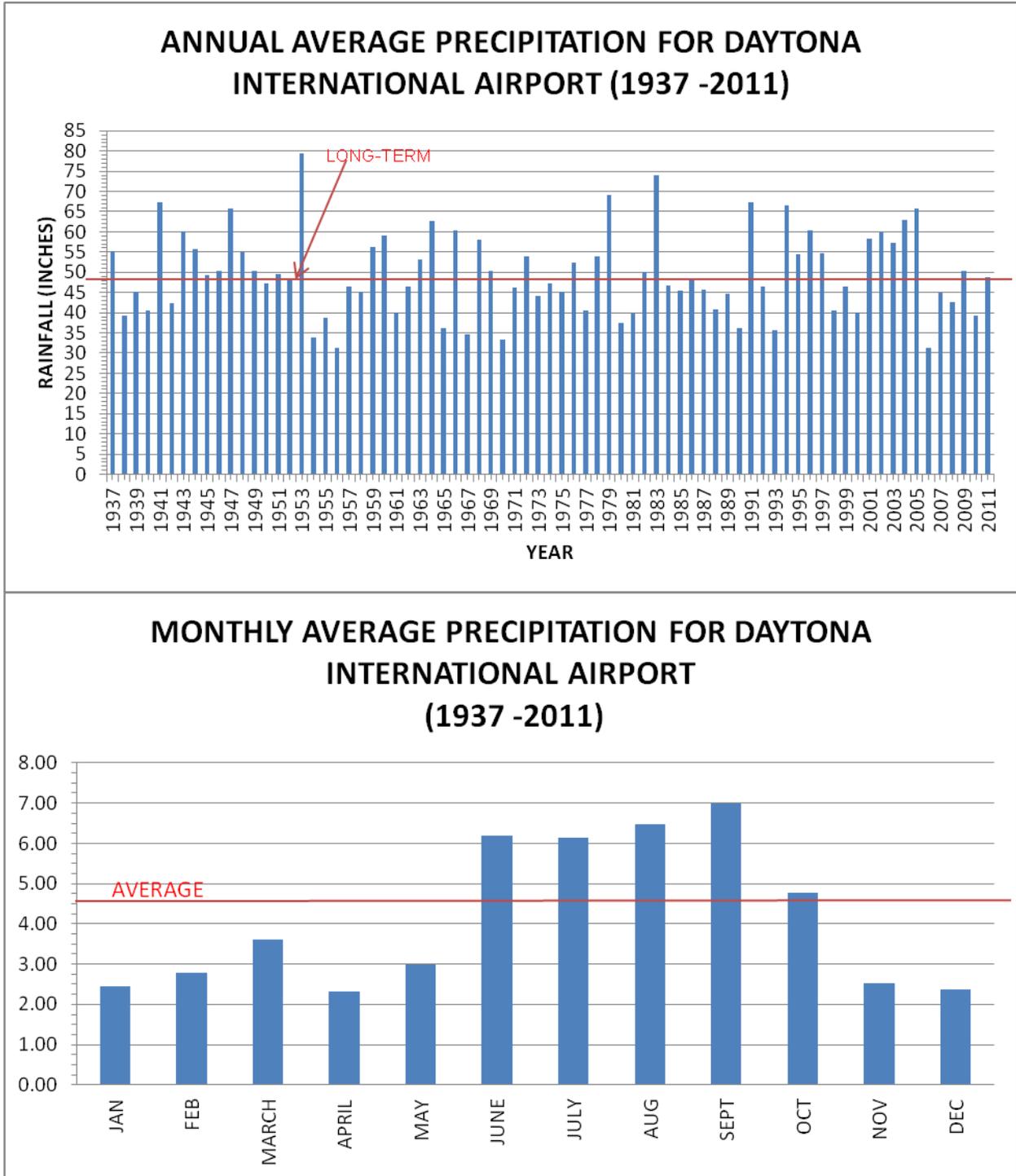
Source	Sum-of-Squares	df	Mean-Square	F-ratio	P
Regression	44.404	1	44.404	6.847	0.019
Residual	103.765	16	6.485		

*** WARNING ***

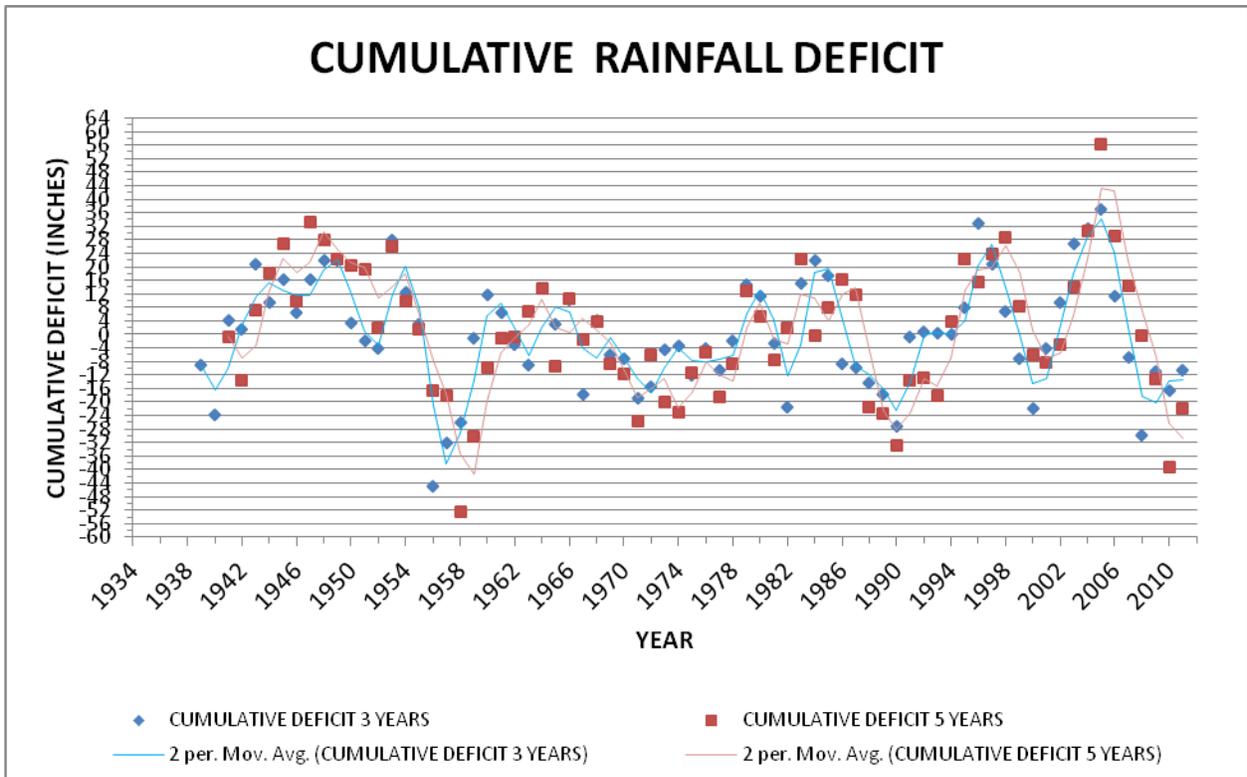
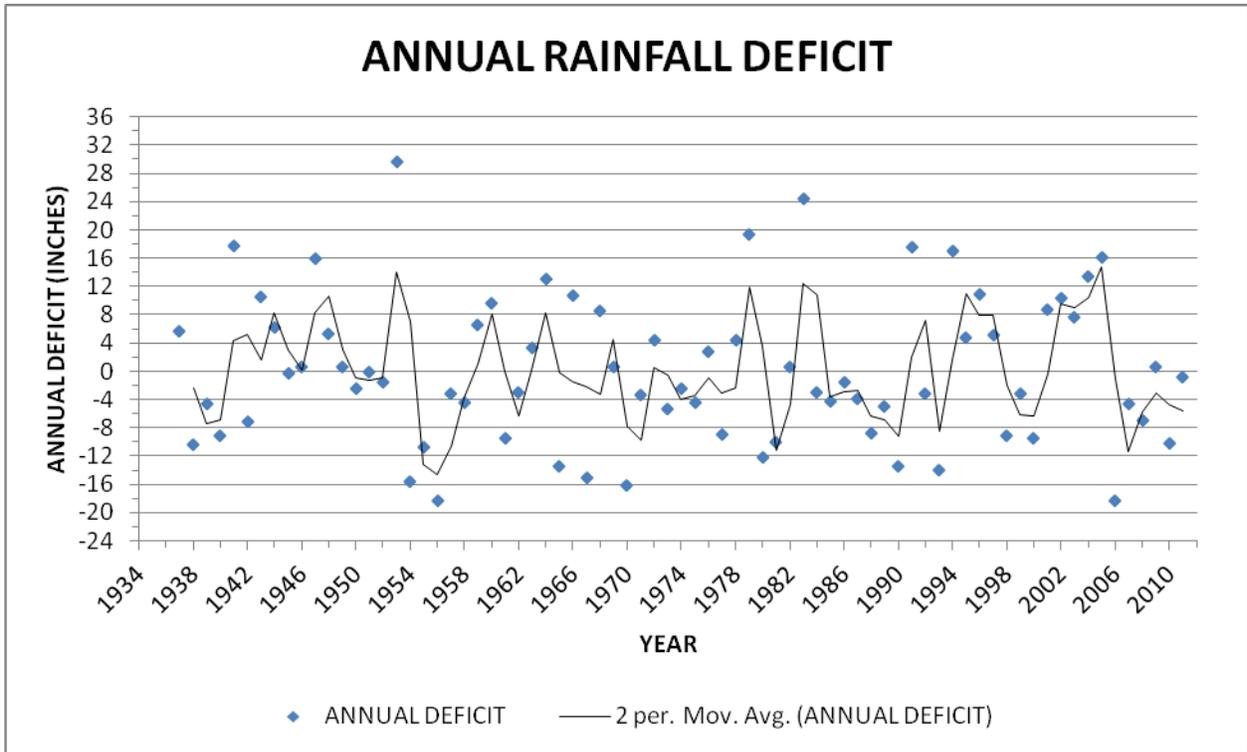
Case 15 is an outlier (Studentized Residual = 2.837)
 Case 16 is an outlier (Studentized Residual = 3.188)

Durbin-Watson D Statistic 1.291
 First Order Autocorrelation 0.354

Appendix J: Annual and Monthly Average Precipitation Plots for Daytona International Airport



US EPA ARCHIVE DOCUMENT



YEAR	ANNUAL TOTAL (INCHES)	RANK	PERCENTILE
1956	31.36	1	1.33%
2006	31.36	2	2.67%
1970	33.4	3	4.00%
1954	33.96	4	5.33%
1967	34.58	5	6.67%
1993	35.71	6	8.00%
1990	36.12	7	9.33%
1965	36.13	8	10.67%
1980	37.36	9	12.00%
1955	38.8	10	13.33%
1938	39.29	11	14.67%
2010	39.39	12	16.00%
1981	39.68	13	17.33%
1961	40.06	14	18.67%
2000	40.16	15	20.00%
1998	40.51	16	21.33%
1940	40.56	17	22.67%
1977	40.67	18	24.00%
1988	40.91	19	25.33%
1942	42.4	20	26.67%
2008	42.67	21	28.00%
1973	44.23	22	29.33%
1989	44.65	23	30.67%
2007	45.02	24	32.00%
1939	45.09	25	33.33%
1958	45.15	26	34.67%
1975	45.19	27	36.00%
1985	45.38	28	37.33%
1987	45.72	29	38.67%
1971	46.23	30	40.00%
1999	46.37	31	41.33%
1992	46.41	32	42.67%
1957	46.48	33	44.00%
1962	46.59	34	45.33%

YEAR	ANNUAL TOTAL (INCHES)	RANK	PERCENTILE
1984	46.71	35	46.67%
1974	47.21	36	48.00%
1950	47.22	37	49.33%
1986	48.01	38	50.67%
1952	48.1	39	52.00%
2011	48.71	40	53.33%
1945	49.36	41	54.67%
1951	49.46	42	56.00%
1982	50.18	43	57.33%
1949	50.22	44	58.67%
1969	50.22	45	60.00%
1946	50.3	46	61.33%
2009	50.3	47	62.67%
1976	52.32	48	64.00%
1963	53.03	49	65.33%
1972	53.94	50	66.67%
1978	53.94	51	68.00%
1995	54.44	52	69.33%
1997	54.69	53	70.67%
1948	55	54	72.00%
1937	55.29	55	73.33%
1944	55.81	56	74.67%
1959	56.24	57	76.00%
2003	57.3	58	77.33%
1968	58.17	59	78.67%
2001	58.27	60	80.00%
1960	59.18	61	81.33%
2002	59.94	62	82.67%
1943	60.11	63	84.00%
1966	60.25	64	85.33%
1996	60.49	65	86.67%
1964	62.76	66	88.00%
2004	62.97	67	89.33%
1947	65.64	68	90.67%
2005	65.77	69	92.00%

YEAR	ANNUAL TOTAL (INCHES)	RANK	PERCENTILE
1994	66.64	70	93.33%
1991	67.19	71	94.67%
1941	67.3	72	96.00%
1979	69.02	73	97.33%
1983	73.99	74	98.67%
1953	79.29	75	100.00%

[Appendix K: Response to Comments](#)